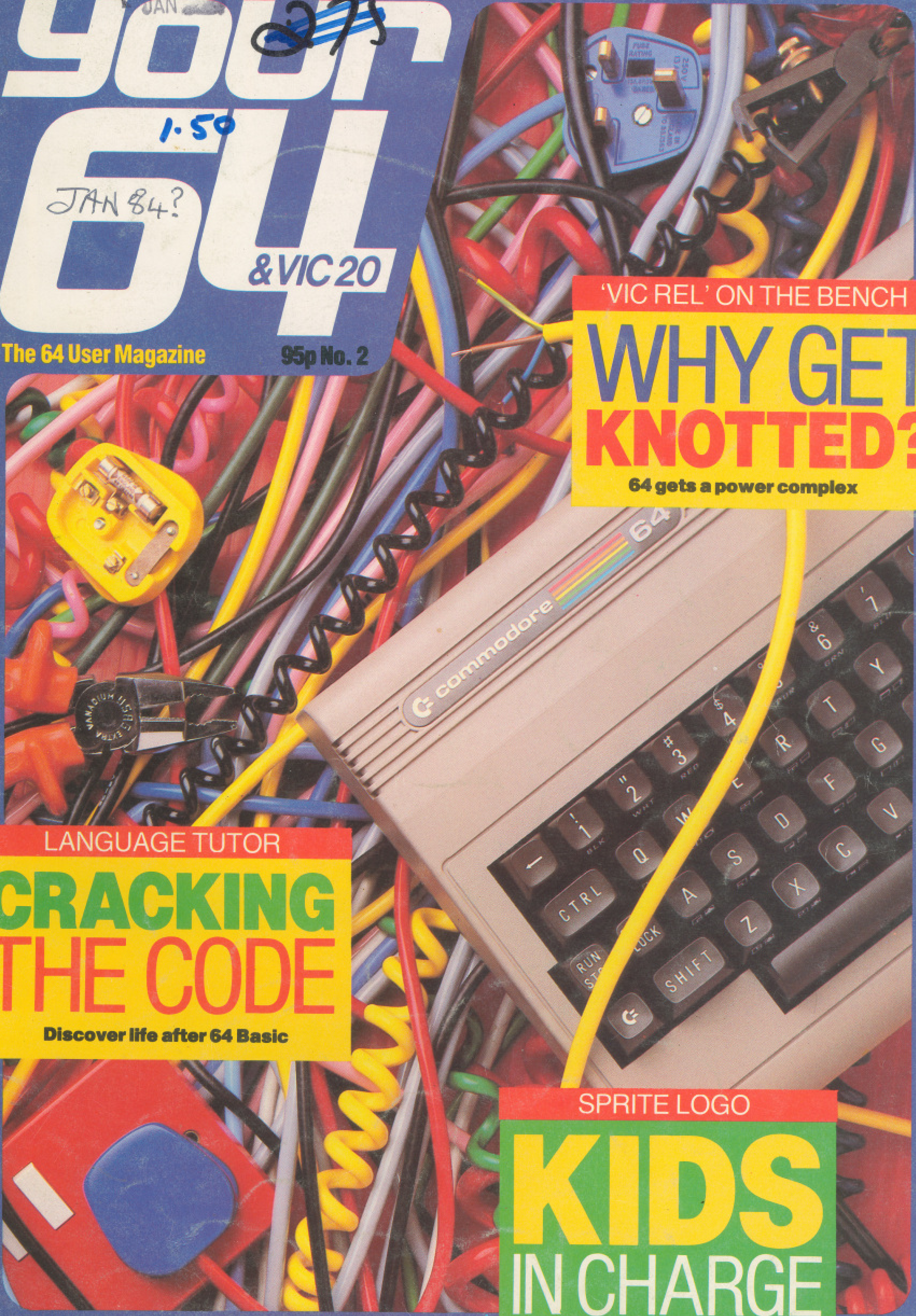
COMMS COMPETITION: MODEMS TO BE WON!

Your 64 & VIC 20

The 64 User Magazine

95p No. 2

JAN 84?



'VIC REL' ON THE BENCH

WHY GET KNOTTED?

64 gets a power complex

LANGUAGE TUTOR

CRACKING THE CODE

Discover life after 64 Basic

SPRITE LOGO

KIDS IN CHARGE

Designing a keyboard bypass

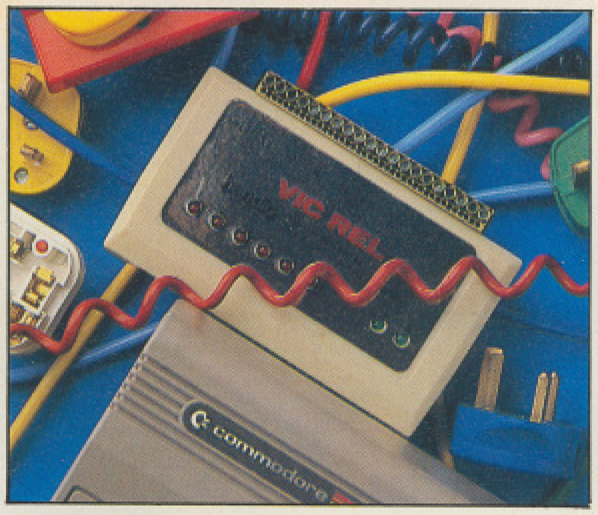
Y64 MENU

FEATURES





UNDER REVIEW



CORE MATERIAL

THANKS

Your 64 has been written and edited with the help of an Osborne 1 microcomputer. We'd like to thank Osborne UK Ltd for its kind provision of the machine. The magazine also wishes to thank both 'Tomorrows World' (of Oxford Street) and 'Pilot Software City' (of Rathbone Place) for their generous loan of hardware and software.

TAKE NOTE

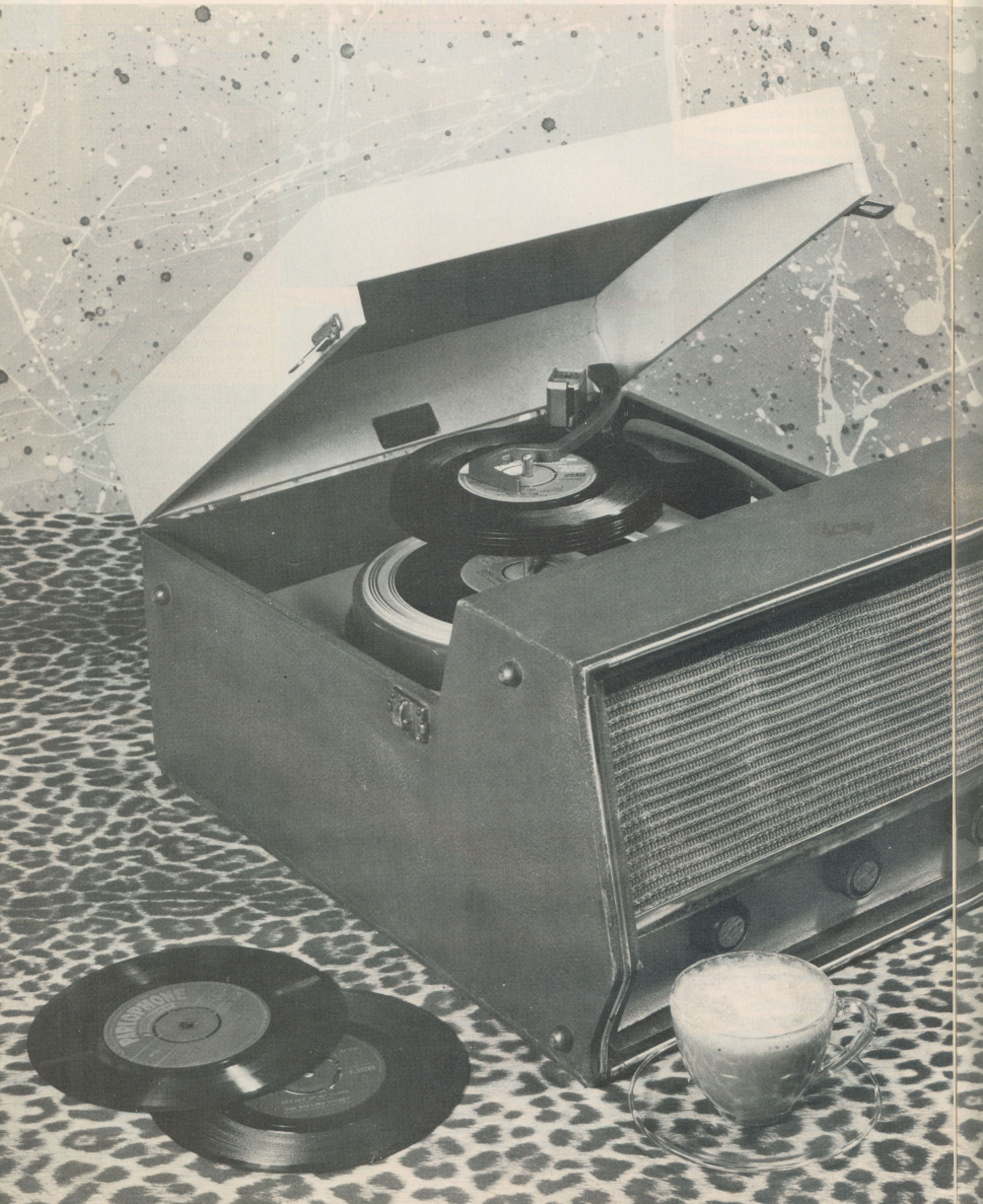
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Your 64 is now a monthly publication.

Amazing how played out some things



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Remember the days when every record player was gifted with a needle instead of a stylus. 45's were "in," 78's were "out."

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Making the most of your micro.



Level 9 — on the trail of the environmentally aware robot

It doesn't take a genius to notice that interest in the 64 continues to grow, with software houses writing bigger, better and ever more enjoyable games. Three that'll probably fit into that category are on their way from **Level 9 Adventures**, and they'll most likely make use of turbo-loading to speed up the 64's notoriously slow program loading.

The first, *Return to Eden*, is going to be a sort of ecological fable where robots have gone on ahead to build a city fit for human habitation. However, due to a sad insensitivity to all things living, they've brought on an almighty war between themselves and a bunch of semi-intelligent plants. It'll be your job to put things right by reprogramming the mechanical monsters to make them more aware of their environment.

Next comes *Time and Tide*, a game based loosely on Greek mythology. Said Level 9's Pete Austin, "It begins with the time lords having taken over Atlantis. There's plenty of opportunity to meet the gods and have a few laughs — we've included lots of humour."

Last of the upcoming trio is *Red Moon*, a graphics adventure in which the player will have to find the red, crystallised moon that's been carelessly mislaid.

Both *Return to Eden* and *Time and Tide* are text-only adventures which will retail for £9.90; *Red Moon* will be cheaper at £7.50.

Starcade's birds display some very anti-social habits!

A new game from **Starcade** takes us away from the green of the cricket pitch and up into the clear blue skies above for a ride in a hot air balloon. Entitled *Up, Up and Away*, it'll feature high-res graphics, and scroll as you travel from base to base. You'll need to watch out for the windmills, flying circuses and children with kites, because they'll all be trying to bring you back down to earth with a bump; beware too the bovver-booted vandals who'll use you for target practice with their stones. And if that isn't enough, flocks of birds with very anti-social habits will be lurking overhead.

Says Starcade spokesman Tom Jones, "It's going to be great fun to play, and with five skill levels, it'll be quite difficult at times — especially since you have to keep an eye on the fuel supply." Still, you can always throw out a few sandbags. The program, currently under development, should be available in Boots and Websters towards the end of the summer, and will cost £6.95.

Another company on the trail is **Gilsoft**, an outfit famous for the utility that enabled Spectrum owners to write their own machine code adventures. It's currently working to adapt *The Gold Collection* (previously written for the Speccy) to run on the Commodore. Containing no fewer than seven adventures, the first is called *African Garden*. Set in a hotel, the aim here will be to solve the mystery of the missing Mr Robinson and find the treasure. Next comes *Mind bender*, a two-parter in which you'll have to escape the clutches of a secret organisation and its mind-bending machine. All of which is quite different to *Magic Castle*, where there'll be a princess to be rescued and vampires avoided. Then comes *Diamond Trail*, a game where the player will have to rescue the inappropriately named (for the 64, anyway) Sinclive diamond.

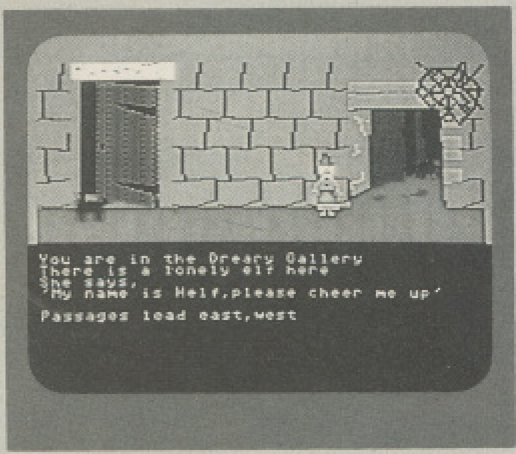
Fifth up is *Spy Plane*, an adventure that'll have you detecting enemy sea positions; and then comes *Devils Island*, home of the French penal colony, where the aim will be to escape and gain your freedom. Finally, waiting in the wings is *Barsak the Dwarf* (anagram of skarab, or — nearly — Bar-snack) who'll need some help in recovering his ancestor's treasure from the underworld of mythology. All seven programs will be available over the next few months for between £6 and £7.

Glancing at the output from a number of software houses — not least those already mentioned — it's clear that not only are adventures gaining in popularity, but the scenarios are growing ever more strange. Take the latest project being worked on by **Anirog Software** programmer, Marion Clark. Called *Catacombs*, it's set in plague-ridden underground caverns (which are divided into holy places and unholy places) and the player's task will be to search for a book of spells that will help cure the inhabitants. But spells, as everyone knows, need ingredients — like spit of bat, eye of frog, tail of cat, hair of dog — and so on. Having found all these, you have to set about casting the spell and curing the people.

"It's a non-sexist adventure; as you can choose to be either a boy or a girl — the other person becoming your companion," explains Marion.

Staying with adventures, word now on a slightly mysterious game from **PSS**, codenamed *Dungeon*. According to Campbell McCauslande, "It has real-time 3D graphics, and switches from text-mode to combat-mode, depending upon the kind of situation the player finds himself in. There's also a limited map display in case of trouble." Unfortunately, no amount of cajoling would tempt Campbell into discussing aims and objectives; all he'd say was that *Dungeon* had been in development for 18 months, and would be out in time for Christmas.

Ron Smith



Anirog's Catacombs

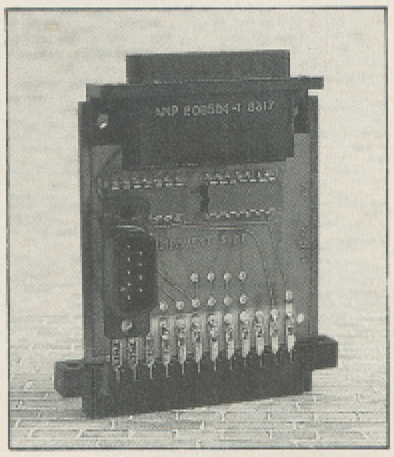
Give Peace a Chance

Play for life, a voluntary organisation formed to encourage the production of creative and constructive play-things for 5-12 year olds, is appealing for examples of non-violent, non-competitive software for a forthcoming guide.

The guide is intended to be of use to parents who want to know where to find an alternative to games and toys based on competition and destruction. The software section is being compiled by Keith Ollett, who can be contacted at Hookstead, Goldsmith Avenue, Crowborough, East Sussex.

Fixing Sticks

If you've ever had problems with a joystick, you'll know how difficult and/or expensive it can be to get it fixed up again. Now, Boston-based Computer Supplies has come up with an answer for all frustrated users of the mighty stick: a fast joystick repair service. For £3.45 including postage, it aims to repair most types of joystick and have them back on the road within 24 hours. Details on 0205 50239.



Impex's RS232 interface

Getting Hooked

Anyone who's ever tried to hook-up a modem or any other type of serial device to a 64 or VIC will know what an involved job it can be. Most applications involve a good deal of soldering and swearing — and fervent wishes that someone had told Commodore about RS232 interfaces.

Now Impex Software supplies a low-cost, add-on RS232 interface which simply plugs into the 64 or VIC expansion port. The device is priced at £24.45 including VAT and P&P. Details on 01-900 0900.



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Side-Stepping Datasette

An alternative to the expensive Commodore datasette is to use a standard cassette player with a CBM 64 interface. Two such interfaces are known to us: one from Glanmire Electronics, priced at £13.99, the second from Stonechip Electronics, price £14.95. Both plug into the Datasette interface on the 64, providing standard jack plugs for ear, mic and remote. Plug into Glanmire on 010-353 021 889209, or Stonechip on 0253 333361.





Glanmire's cassette interface ... and Stonechip's too

The Cutting Edge

Audiogenic has cut the price of many of its 64 and VIC games — some by more than 50 per cent. Many £8.95 pieces have been reduced to £5.95, while the cassette version of the *Grandmaster* chess program (reviewed last issue) has been slashed (as they say) from £17.95 to £8.95.

Managing director Martin Maynard commented that the "huge success of our software means that Audiogenic is able to pass the benefits directly to the customer in the form of lower prices". New products manager Henry Smithson gave a slightly different view. "We were able to charge £8.95 for most of our products because we were one of the first companies to produce software for the 64. Now there's a lot of competition and we have to bring our prices down to the going rate. *Grandmaster*, for example, used to be the only chess program for the 64, so we exploited the situation by charging a premium price for it. Now it's no longer the only package available, we've found that it isn't sufficiently superior to compete at that price." (Those unused to 84 'new speak' could try replacing "sufficiently superior" with "good enough"!)

Smithson said that he also expects cuts in the prices of Audiogenic's business software. Details on 0734 664646.

High Speed Back-Up

Newly-formed one-man software house Dosoft has entered the 64 market with two controversial utilities. *Hypersave-64* allows you to create your own 'turbo-loading' software. By saving your programs in a special Hypersave format, it'll subsequently load at speeds comparable to the 1541 disk drive. As a matter of academic interest, *Hypersave* will also duplicate many commercial programs (Dosoft helpfully explains how to Hypersave *The Hobbit* in the accompanying documentation).

Backup-64 is exactly what the name suggests: a program designed to copy most types of copy-protected software. The documentation gives detailed instructions on how to duplicate *Twin Kingdom Valley, Blagger* and *Mr Wimpey*, as well as providing the start addresses for other well-known titles.

Hypersave costs £7.50, *Backup* £3.50 or both programs for £9.99. Mail order them from Dosoft — details on 0253 593288.

In The Net

Compunet, Commodore's alternative to Prestel, has now been launched. The viewdata system offers most of the services provided in the Micronet 800 area of Prestel: electronic mail, downloading of commercial and public-domain software, specialist information and so on. For £99, 64 users get a Commodore 1200/75-baud modem, Compunet comms software and a year's subscription to the service.

The system has some attractive features — including full error-checking, for example. If the phone line is bad enough, it means you'll get absolutely nothing; on the other hand you can't end up sending a confidential message to the wrong mailbox, or ordering £50 of unwanted software simply because of line-noise!

The communications software is stored in ROM form in the modem itself, but additional routines are automatically downloaded from Compunet into RAM as required. This gives Commodore a relatively secure system, while supplying the user with a neat and painless way of receiving updated software.

The system is extremely easy to use, three keys being all you need to step through and select from a directory 'tree' — an improvement on the Prestel system of page numbering.



Compunet: 64s only at present, but other machines will follow

The method of billing for the service is considerably less attractive. You have to fill out a bank mandate authorising Commodore to debit your current account by unspecified amounts at unspecified intervals. While Compunet would appear to be more secure than Prestel, there isn't a system in Christendom that can't, and won't, be broken into.

Y64 will be carrying out a review of Compunet in a future issue. In the meantime, details and order forms are available from Commodore on 0753 79292.

Mixed Talent

Take a professor and a doctor of computer science, add the former publicity officer of the Scottish Ballet and throw in the University of Strathclyde, and you've got a rather unlikely, but apparently successful, recipe for a software house.

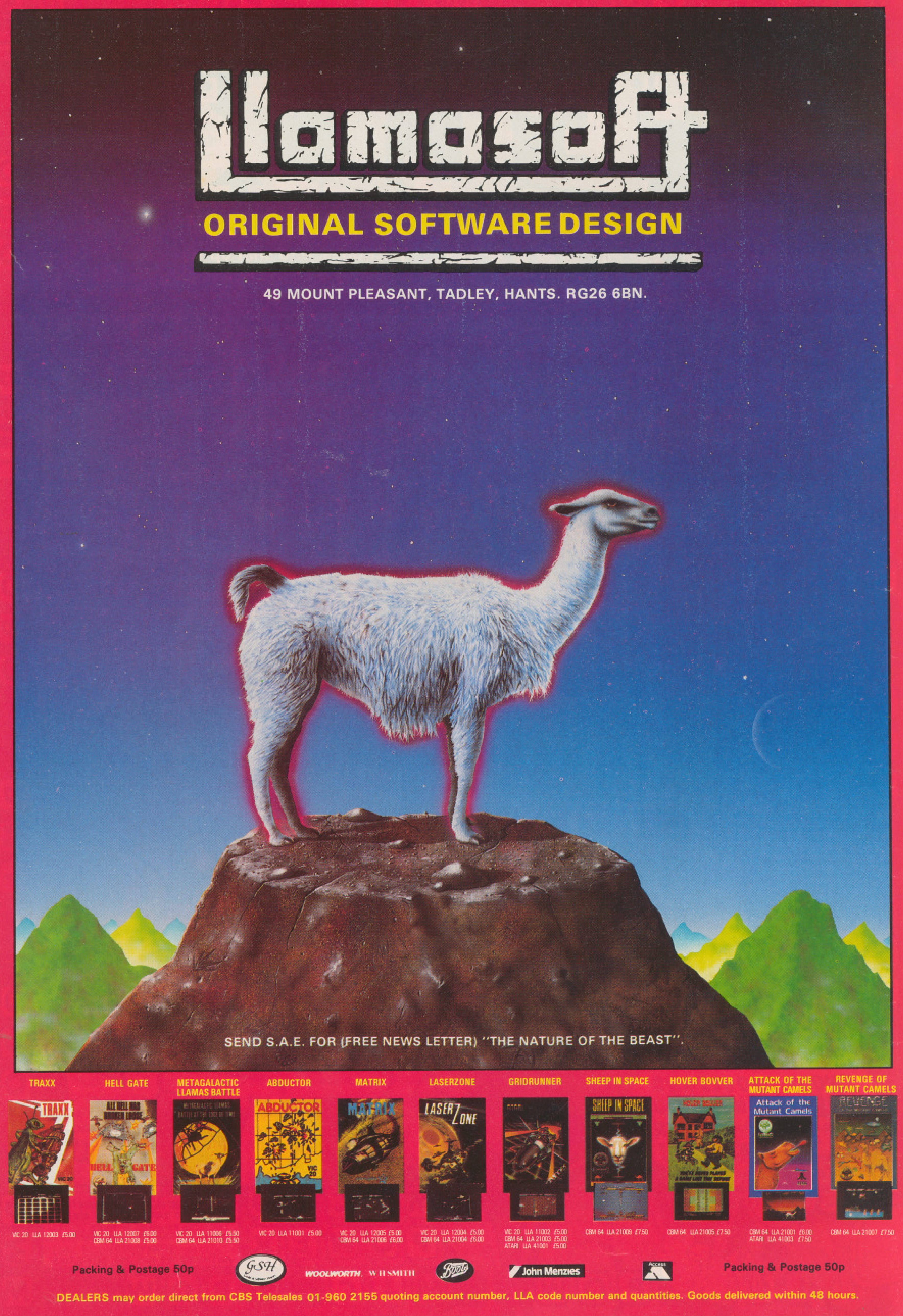
Talent Computer Systems has just launched four programs for the 64: a text-and-graphics adventure; an arcade game set on a desert island; a computerised version of Kalah, an ancient and deceptively complex desert game; and a sophisticated graphics package, which Talent uses to produce the graphics for its 64 games software.

Talent was formed by two members of the Computer Science Department at Strathclyde University — Professor Andrew Colin and Dr Jon Malone — together with Veronica Colin (the aforementioned publicity officer). The university was given a fourth partnership in the company in return for the use of its resources. According to Veronica Colin, the university sees Talent as "a chance to show that academics can be useful as well as clever".

Gain further enlightenment by ringing 041-552 2128.



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SOFT STACK

Your 64's collection point for the latest business, education and utility packages.

The software discussed here is mostly unseen and untested, so don't take inclusion as any kind of guarantee of usefulness or availability. If you have something you'd like us to include here in a future issue, send details to: Soft Stack, Your 64, 14 Rathbone Place, London W1P 1DE.

DATABASE

Audiogenic has announced the launch of a new database program, **Magpie**, designed for ease of use by the inexperienced operator. Some 95 per cent of its operations are controlled by just three keys: two for moving the cursor up and down, the third for selecting the chosen entry. Once this has been done, a second (overlapping) menu is displayed showing you not only where you are, but also how you got there. The same applies to all subsequent selections. Supplied on cartridge, it is priced at £99.95. Further information from Audiogenic on 0734 595647.

Ssoftdata is a new database suitable for either home or small business use. It allows up to 1000 records with a maximum of ten fields to be created, and these can then be updated, sorted or deleted at will. Output format is user-definable, and can be sent either to the screen or a printer. It's available from Ssoft Computer Software (on 061-973 1097) at £14.95 (cassette), £19.95 (disk).

Oracle is a full function database system specifically designed to provide fast management of high volume information. It allows the user to create customised record formats of up to 12,000 characters, giving up to 99 fields per record, with each field being a maximum of one screen and each record a maximum length of nine pages. Maximum file size is 170 Kbytes using the 1541 drive. The price is £89.95 for either the 64 or the SX-64, and copies can be ordered from Kobra Micro Marketing on 01-997 6666.

HOME ACCOUNTS

Ssoftbank is designed to keep an up-to-date file of all transactions with date-to-date display and forecast features included. It'll accept multiple or single entries, and allows the sorting and entry of standing orders as a single entry. Functions comprise sort, delete, edit and print. Available from SSOFT Computer Software (on 061-973 1097) price £9.95 (cassette), £12.95 (disk).

WORD PROCESSING

A combined, cassette-based, wordprocessing and database system costing £12.95 has been launched by Audiogenic. Called **Home Office**, it's designed to provide the business user with a wide range of WP and DB facilities. The wordprocessor is designed to enable letters, documents and reports to be created easily and accurately, with the completed files being stored on either tape or disk. The database section is intended to offer a storage and retrieval system for use in either the home or small office. Further information from Audiogenic on 0734 664646.

PaperClip, from Kobra, is claimed to be a very sophisticate wordproocessing package that gives the user the flexibility to correct typing errors, rearrange parts of a document, and allow easy manipulation of the text. It includes a global search feature that enables the user to change all occurrences of a word or phrase over any number of linked files, in addition to all the normal functions such as centring, justification, emboldening, underlining and italicising of text. Supplied on disk for £89.95, you can get it from Kobra Micro Marketing on 01-997 6666.

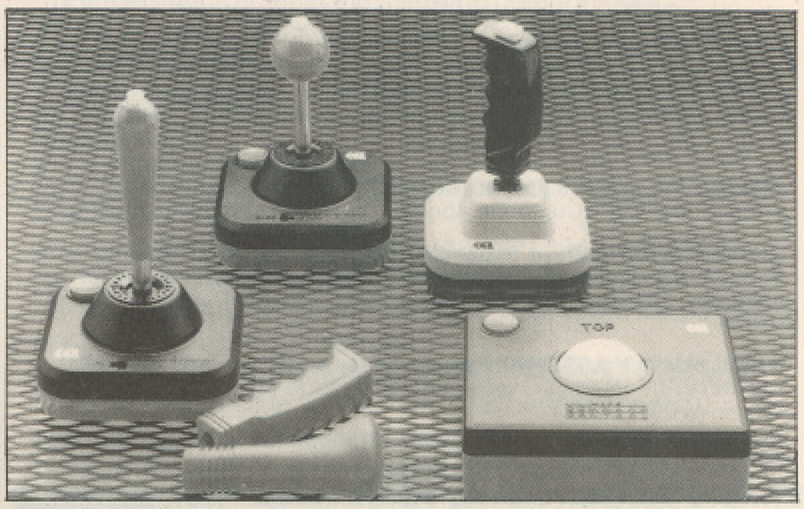
Bubble Bus Software has announced the release of an updated version of its **Word Wizard** wordprocessing system, which can now be run in conjunction with Commodore's 1520 printer/plotter and is also compatible with most other Commodore and Epson printers. Text can be set to either 40 or 80 column width. It costs £6.99 and Bubble Bus is on 0732 355962.

Commodore Show Down

The Fifth International Commodore Computer Show, due to have taken place in Leeds on the 27-29th September, has been cancelled.

Commodore blames the cancellation on the move to the company's new Corby site. "A great many of our staff and resources will be tied up in the move," explained retail marketing manager Aileen Bradley. "Rather than staging the show without a full complement, we decided to postpone it for the time being."

The company also holds production of the new Plus 4 and CBM 16 as a factor in the decision. Said Bradley, "Demand for the new machines will be extremely heavy during the run-up to Christmas. In order to meet that demand, our major priority during September will be to bring production up to full strength as soon as possible."



Wico Gives New Guidance

Joystick connoisseurs can choose from four new Wico joysticks marketed in the UK under the CGL brand-name. From left to right they are: the 3-way joystick, featuring two independent fire buttons and three interchangeable handles (£25); the Red Ball joystick, using a 6-leaf assembly to provide an 8-directional action, and two fire buttons (£23); the Boss, a basic and low-priced stick (£13); and the Trackball, with 360-degree movement (£45). All are available now from high-street outlets.

Soft Soap

It's the computer game of the video nasty. Yes, for all those fans of the evil JR and 'Superwally' Cliff Barnes, software house US Gold has produced a graphics adventure program based on the TV series *Dallas*. You'd better believe that it's the real thing because the story line for *Dallas Quest* was apparently written by Lorimar, the company that produces the TV series.

Paranoid alcoholic, Sue Ellen, retains your distinguished detecting services to locate a map revealing the whereabouts of a multi-million dollar oilfield. As you slog your way through the land mass of South America, you're assailed at every turn by JR and the other scheming inhabitants of Southfork.

The game is available on disk only, priced at £14.95. Details on 021-520 7591.

Playing Nasty Games

Newly-formed Palace Software has released a game based on the film *The Evil Dead*. The plot (if it can be described as such) revolves around a bunch of teenagers trapped in an isolated cabin by ancient spirits of the undead. Having nothing much else to do, they transform themselves into demonic monsters bent on mass-murder. The game, apparently, "follows closely the plot of the film".

Palace Software is part of the Palace Group (whose offshoots include Palace Pictures) and the company is fully intending to produce further film-based games. For those of a more nervous disposition, it's only fair to warn you that some of the other films marketed by Palace Pictures include *Diva, Basket Case* and *The Texas Chainsaw Massacre*.

Whoops!

There was an error in the instructions accompanying the machine-code loader in the *Firing-up Basic* feature. You should not enter an entire line before pressing RETURN; you should press RETURN after each individual byte. Thus, the first line of the hex dump would be entered as follows:

```
C000 (RETURN)
4F (RETURN)
4C (RETURN)
44 (RETURN)
00 (RETURN)
4D (RETURN)
4F (RETURN)
56 (RETURN)
45 (RETURN)
X (RETURN)
```

After entering the final 'X', you will be returned to the 'Enter start address' prompt. You then enter C008 (RETURN) and proceed as above for the second line. When you have entered the entire listing, type another 'X' when you get the start address prompt.

Our apologies to everyone who got an 'Illegal quantity in 120' error and couldn't figure out why.

Puzzlepoint 2

By Mike Liardet

Those of you who are well-versed in the ways of computers will know that internally they represent letters and digits, and all the other text symbols, by different combinations of seven binary digits. For example the letter "A" is encoded as "1001101", " " (ie space) becomes "0100000", and "@" is encoded as "1000000", etc.

Using this scheme, a text's minimal storage requirements, in binary digits ("bits" for short), can be computed as 7 times the number of characters involved. This month's competition is a challenge to find a better scheme than this. Even if you don't win you won't find your efforts wasted — you will discover enough to be able to compress messages in any of your programs that are running short of memory!

Consider this: If...
"A" were encoded as "00"
"B" were encoded as "01"
"N" were encoded as "01"
" " were encoded as "110"
(Any other characters would have at least 4 bits, starting "111..") then, the phrase "NAB A BANANA BABA" would consume only 37 bits for the 17 characters.

Right! Take the first two paragraphs of this problem, convert them as specified below, then devise an encoding scheme which minimizes their storage requirements. There are £10 book tokens awaiting the three readers with the best solutions.

GROUNDRULES

1. Please write the number of bits required on the back of the envelope.
2. All entries *on paper* please — no cassettes or disks.
3. All material will be retained by *Your 64* and may be reprinted without further permission.
4. Entries must arrive by September 30th, and the judge's decision will be final.
5. Solutions should be supplied in the form:

```
1000 DATA bit-code for the
          quotation character
1010 DATA number of other
          characters encoded
1020 DATA first character (e.g.
          "A"), its bit -code (e.g.
          "01")
1030 DATA second character,
          etc., etc.
          DATA last character,
          its code
```

Note that the bit-codes are to be listed as text-strings, not as decimal numbers. You must exclude all characters not present in the actual text ("Z", "J" and so on).

6. The text to be encoded is formed by joining the first two paragraphs here together (including any typographical errors!), and then converting them to upper case. Each word is to be separated from the next by a single space. Thus the problem will look like this: THOSE OF ..... 00", ETC. USING..... MEMORY!

PUZZLEPOINT 1 SOLUTION

A rather low entry to our first Puzzlepoint, and only a few of the entrants actually managed a solution which fully satisfied the rules given.

Congratulations therefore go to R.A. Walden of Southsea in Hants who devised the following formula:

$2 * 3^{(N/2)}$

as an alternative to the Titus-Bode law for calculating planetary distance from the Sun. Using this formula, the total percentage error, for all nine planets, is only 100.685%.

The £10 book token is on its way.

CLASSIFIED INFORMATION

Welcome to the classified advertisement service that's free to readers of Your 64.

Please check against the following categories of advertisement (make up your own if nothing fits):

HARDWARE
SOFTWARE
WANTED
CLUBS & EVENTS
MESSAGES

Anything (that's legal and within reason!) goes, but with the following proviso. Entries in the 'Software' category will have to be restricted to *swaps only*. . . sorry, but the pirates are doing well enough already.

Just fill in the form below using CAPITAL LETTERS and restricting yourself to a maximum of 30 words per enty (including name, address/phone number). Use a photocopier if you want to keep the magazine intact.

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YOUR OWN CHOICE CHARTS

Here is the result of our first issue reader's poll on games software. Don't forget to keep letting us know your top five favourite flings on the Commodore 64 — by filling in the polling slip on this page.

You'll notice that, this month, the form has a little extra space by each entry. That's so you can tell us — in just a few words — why you rate each of the five games. We'll be picking out the most interesting comments from the month's polling slips, and using them on the chart — along with name checks of the senders.

As ever we'll be sending a clutch of new software to the sender of the first card out of the bag. The winner for this month is *Robert Cockcroft* of Saddleworth, near Oldham.

YOUR 64 CHOICE TWENTY

My top five games for the **Commodore 64** are:

1 ______
(comment) ______

2 ______
(comment) ______

3 ______
(comment) ______

4 ______
(comment) ______

5 ______
(comment) ______

Name ______

Address ______

All polling slips should be mailed to: **Your 64 Choice Twenty, 14 Rathbone Place, London W1P 1DE.** (By all means send a photocopy if you'd prefer not to harm the issue.)

YOUR 64'S TOP TWENTY

THIS MONTH	LAST MONTH	TITLE	
1	1	**INTERNATIONAL FOOTBALL** COMMODORE	REAL TIME FOOTBALL GAME VERY IMPRESSIVE ANIMATION AND GREAT SOUND.
2	↑ 3	**REVENGE OF THE MUTANT CAMELS** LLAMASOFT	LASER SPITTING CAMELS FIGHT AGAINST VARIOUS ODDITIES.
3	↑ 4	**MANIC MINER** SOFTWARE PROJECTS	A TWENTY-LEVEL GAME THAT HAS YOU TAKING ON THE ROLE OF MINER WILLY.
4	↓ 2	**FORBIDDEN FOREST** AUDIOGENIC	A HUGE COMPLEX MULTI-LEVEL ARCADE ADVENTURE GAME.
5	↑ 9	**THE HOBBIT** MELBOURNE	A VERY POPULAR GRAPHIC ADVENTURE, BASED AROUND TOLKIEN'S BOOK.
6	↑ 18	**HUNCHBACK** OCEAN	ASSIST QUASIMODO AVOID THE GUARDS' SPEARS TO RESCUE THE BEAUTIFUL ESMERELDA.
7	↑ 15	**FALCON PATROL** VIRGIN GAMES	AS SOLE SURVIVOR OF THE FALCON PATROL, YOU MUST DESTROY THE ATTACKING ENEMY AIRCRAFT
8	↑	**AZTEC CHALLENGE** US GOLD	A PACKAGE OF MULTIPLE ARCADE GAMES, BUT ADVENTURE-STYLE ENDING.
9	↑	**BEACH-HEAD** ACCESS	BATTLE TO ESTABLISH A BEACH-HEAD USING SHIPS, TANKS AND PLANES IN THIS ENTHRALLING GRAPHICAL ADVENTURE.
10	10	**SIREN CITY** INTERCEPTOR	YOU'RE A NEW YORK COP DRIVING A 'BLACK & WHITE'. THE AIM IS TO CATCH THE VILLAINS.
11	↓ 5	**BUGABOO** QUICKSILVA	SUPERB CARTOON GAME INVOLVING YOU (THE FLEA) AND A LARGE DRAGON.
12	↑ 19	**MR WIMPY** OCEAN	AVOID THE BURGER THIEF AS YOU COLLECT THE INGREDIENTS TO CONCOCT THE 'DELICIOUS' BURGERS.
13	↑	**COLOSSUS CHESS 2.0** CDS MICROSYSTEMS	THE ONE, THAT BEATS 'EM ALL. BUT REIGNS IN THIS AREA TEND TO BE SHORT
14	↑	**SON OF BLAGGER** ALLIGATA SOFTWARE	MOVE ABOUT A 12-SECTION SCREEN COLLECTING KEYS AND OVERCOMING ALL THE MEANIE OBSTACLES.
15	↑	**SUPER PIPELINE** TASK SET	THE AIM IS TO FILL A BARREL. FIRST THOUGH YOU HAVE TO BUILD A PIPE.
16	↑	**CHINA MINER** INTERCEPTOR	BACK TO THE UNDERGROUND IN AN ARCADE-TYPE GAME SIMILAR TO MANIC MINER.
17	↑	**CUTHBERT IN THE JUNGLE** MICRODEAL	OUR ALL-PURPOSE HERO IS BACK THIS TIME TO RESCUE THE JUNGLE GIRL.
18	↑	**HOVER BOVVER** LLAMASOFT	DASH AROUND THE HEDGES AND FLOWERBEDS WITH THE NEIGHBOUR'S LAWNMOWER, WHILE AVOIDING ROVER AND JIM FROM NEXT DOOR.
19	↑	**MEGGA HAWK** BIG G	FROM THE LONG LINE OF SHOOT-'EM-UP ARCADE GAMES. THIS INCLUDES A SCRAMBLE EFFECT.
20	↑	**SLINKY** OSMI	IMAGINE ONE OF THOSE SLINKY SPRINGS THAT 'WALKS' DOWN STAIRS . . . HERE THOUGH THE ACTION TAKES PLACE ON A CUBIC GRID.

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MISSIVES

The reader's port into the Y64 machine. Send information to:
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Musical Cheers

I would like to congratulate you on the quality of *Y64*. The major feature which appeals to me is that around 50 per cent of the magazine is of interest to the serious amateur programmer, through a good combination of reviews, programs and technical data. The 'Keyboard Kapers' — unlike many magazines — was easy to read and well-explained. The magazine promises to be most fruitful, and I look forward to future issues.

Those of your readers interested in music may like to know of a book entitled *The Commodore 64 Music Book* by J Vogel and NB Scrimshaw. I found it to be one of the most informative, lucid and well-described books on the market. It takes one through fundamental basics to streamlined data programming for music.

A listing of approximately 60 lines converts the 64 to a playable 3-voice organ with different octaves, chromatic, diatonic, minor and modal scales and a simple listing for conversion to a Flydian modal organ. This is all in Basic; a very satisfying book.

Again, thank you for launching a very fine, well-presented well-varied and interesting magazine.
(Mrs) Eve Mills, B.Sc., Ph.D., Bristol.
Y64 will be reviewing The Commodore 64 Music Book *in a future issue — Ed.*

Blitz Bits

I was fascinated to see in your first issue the listing of a 64 game called *Island Blitz*, supposedly based on "*Blitz* and originally written for the Nascom in the first days of micro-computing."

It wasn't called *Blitz*, and nor was it written for the Nascom; it was originally written for the Commodore PET. The original program (called *Air Attack*) was marketed by none other than Supersoft way back in 1979. In those days the returns that hard-working authors could glean were very much lower than they are today, and to bridge the gap between reward and effort, the author sent the game to *Personal Computer World*, who published it in December 1979.

One interesting feature about the original *Air Attack* is that it was offered to PCW readers with an overlay to create a four-colour display. Some years later, Vectrex was to use the same principle (which appeared first on early arcade machines).

I hope that *Your 64*, too, goes from strength to strength and I'm looking forward to seeing the next issue.
Peter Calver,
Supersoft, Harrow, Middx.

A Better Reset

I read, with interest, in your first issue the article on a Reset switch. I've been using one for a few months now and feel that my design is a neater solution than yours.

Instead of going to the trouble of soldering wires onto the user port, simply wire a switch to pins 2 and 6 of a 6-pin DIN plug which then plugs into the Serial I/O socket on the computer (or the disk drive if fitted). In fact I was able to build a small switch into the casing of the DIN plug. Either way, it means you don't have to open up the machine and it can be plugged or unplugged at will.

The other point I'd like to mention is that your article on *Jumpman* indicated that you can only obtain the game on disk. I have a cassette version by Epyx and also *Jumpman Junior* on cartridge.
Roger Kille, West Sussex.

Few Complaints

I recently purchased the first issue of *Your 64* and was amazed at the quality and standard of your magazine. With its excellent reviews and good tips it altogether formed a very good mag and I hope you can keep it up. I'll now be a regular reader. In future issues, how about a classified ads section where readers can advertise games free of charge? Lastly, I noticed that some of the lines in the programs were too long.
Adrian Murrell (age 12)
Bury St Edmunds, Suffolk.
Your wish is my command — well, sort of — because Classified Information opens up this issue. But the only thing is we're restricting software to swaps. If we didn't, it would just be an open invitation to mass piracy. By the way, the solution with the offending lines is to enter them using the standard Commodore abbreviations. Apologies to all who fell foul of this problem. Ed.

Short Cut

A simple but useful tip which other readers may find handy is the following easy way of forcing a 'cold-start' without having to switch the 64 off and on.

Many programs leave pointers set, and with strange colour combinations, etc. Attempting to load a new program can then result in out-of-memory errors and so on. To avoid this problem, simply make SYS 64738 the last statement in your program instead of END. This resets all pointers and colours, and the random number seed to their default values.
Andrew Plant
Camden Town, London NW1
You can also achieve the same effect on the VIC-20 with SYS 64802. Ed.

Fingers Trouble

I'm writing some educational software on 64s for use in a primary school — but there's a problem. Since young children are not noted for their patience, they tend to start hammering away at the keyboard whenever the computer is busily processing for a few seconds! Please tell me if there is any way of temporaily 'locking' the keyboard, so that it doesn't store lots of meaningless keypresses?
Karen Norton,
Aylesbury, Bucks.
You can disable the little blighters — on both the 64 and VIC keyboards — using the same poke: POKE 649,0. POKE 649,10 enables again. Ed.

Snap Decisions

After reading issue 1, and discovering that your art director is stuck at the deadly piranha-pool of *Aztec Challenge*, I thought I'd better come to his rescue!

The way to cross the pool is as follows:

1. Push the joystick forward with the fire-button depressed.
2. When there are no piranha in front of you, release the fire button.
3. Whenever a piranha blocks your way, press the fire button again and wait until it gets bored and swims away.
4. Don't attempt to change direction — just move in a straight line, using the fire-button to avoid the piranha.

Provided that you're quick on the fire-button, you should then be able to get safely across.
M S Gulzar, Old Trafford, Manchester.

Not Scuba-Doopa

After reading the Durell apology (*Y64* issue 1), I must say that! fully agree with the company's opinion of its own game: it really is lousy! I wrote to Durell complaining about the poor graphics, almost non-existent sound and inadequate control of the diver.

In fairness to Durell, I must report that I received a free

return of post. The game may not have been up to much, but the company certainly impressed me.
Derek Hutchinson, Wallsend, Tyne & Wear.

Saving On Storage

I use Commodore 64s as part of a computer studies course which I teach in a secondary school. Unfortunately, although we have six machines, at present we can only afford a single disk drive. Is there any way of connecting the computers so that they can all share the same disk drive?
Tim Cooke, Croydon, Surrey.
The short answer is — don't attempt to build your own network unless you know exactly what you're doing. There is, however, a switching box called the VIC-Switch that's available commercially. This allows you to connect any combination of up to eight Commodore 64s and VIC-20s to a single disk drive or printer. Ring Handic Software (on 0344 778800) if you want to know more. Ed.

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Sprites that spit

Have you ever wondered how those laser-spitting camels in *Attack of the mutant camels* walked so well? Using this utility by Mitchell Peacock, you can not only find out, you can kidnap (spritenap?) them for use in your own programs!

Sprite Copier allows you to load a Basic or machine-code program, examine any or all of the sprites defined by the program and, optionally, copy any of them to data statements for use in your own creations.

First, type in the listing shown opposite and save it to tape or disk. Then load the program you want to examine. If the program is written in machine-code, you probably won't need to run it; most programs load sprite data directly into the sprite blocks below memory location 16320. Basic programs must be run before proceeding.

Next, load and run *Sprite Copier*. You'll be prompted to enter a sprite number between 0 and 255, and the corresponding sprite is then displayed in four forms: multicolour unexpanded, multicolour expanded, hi-res unexpanded and hi-res expanded. You can then select another sprite, copy the current sprite to data statements, or quit the program.

A convenient method of moving sprite data into your own programs is to copy the desired sprites to data statements, quit the program and then — without clearing the screen — load your own program. Then position the cursor over the data statements and press RETURN.

Incidentally, since software is protected by copyright, it seems logical to assume that this protection covers the sprites defined by a program. If you intend to market software which includes 'kidnapped' sprites, you are strongly advised to obtain permission from the copyright holder beforehand.

```
100 POKE53280,0:POKE53281,0
110 PRINT"■■■■■■■■■■■■■■SPRITE  COPIER"
120 PRINT"■■■■■■■■■■■BY  M.PEACOCK 1984"
130 Q=53248:PRINT"■———MULTI——HIRES—————MULTI——HIRES————"
140 POKEQ,185:POKEQ+1,99:POKEQ+23,3:POKEQ+29,3:POKEQ+2,110:POKEQ+3,99
150 POKEQ+39,15:POKEQ+37,2:POKEQ+38,7
160 POKEQ+4,65:POKEQ+5,99:POKEQ+6,255:POKEQ+7,99:POKEQ+21,15:POKEQ+28,5
170 PRINT"■■■■■■■■■■■■■■"
180 POKE198,0
200 INPUT"SPRITE NUMBER (0-255) ";SP:IFSP>255ORSP<0THENRUN
210 FORY=2040TO2043:POKEY,SP:NEXT
250 PRINT"COPY SPRITE TO DATA = F1"
290 PRINT"TO QUIT PROGRAM      = F3":PRINT"TO CONTINUE ANY OTHER KEY"
300 GETA$:IFA$=""THEN300
310 IFA$="■"THEN1000
320 IFA$="■"THENPOKEQ+21,0:END
350 RUN
1000 PRINT"■■■■■■■SPRITE";SP;"TO DATA":POKEQ+21,0
1010 PRINT"■■FIRST LINE NUMBER FOR DATA":INPUT"■■(2000-63000)■";LI
1020 IFLI<2000ORLI>63000THEN1000
1030 S=SP*64:F=SP*64+62
1040 PRINT"■■"
1050 PRINTLI;"DATA";
1060 DN=DN+1
1070 FORDI=STOS+16
1080 IFDI>FTHENPRINT"■ ":GOTO1170
1090 D=PEEK(DI)
1100 D$=STR$(D)
1110 D$=RIGHT$(D$,(LEN(D$)-1))
1120 IFDI<>S+16THEND$=D$+","
1130 PRINTD$;:NEXTDI
1140 LI=LI+1:S=S+17
1150 IFS>F ORDN=9THEN1170
1160 PRINT:GOTO1050
1170 PRINT"GOTO1300"
1200 FORI=1TODN+1:POKE630+I,13:NEXT
1210 POKE198,DN+1:PRINT"■";:END
1300 PRINT"■■■■■■■■■■>>>>>>>PRESS ANY KEY TO CONTINUE>>>>>>>"
1310 GETA$:IFA$=""THEN1310
1320 RUN
```

The *Sprite Copier* listing. Lines 100-160 select multicolour high-resolution mode and allow access to the sprite pointers. 170-35 is the menu, 1000 onwards is the routine itself.

A Moving Routine

Animation is something that, on the 64, can cause quite a few headaches. To make an object appear to move across the screen, it has first to be plotted in its initial position then erased and replotted in a new position; repeated often enough, the sequence can give the illusion of movement.

To produce this kind of movement, we need some way of displaying a character or symbol at a specific point on the screen. The standard approach is to home the cursor to the top left corner of the screen and then send a sequence of control codes to move the cursor to the specified position.

This arrangement is both clumsy and slow. Fortunately, a search through the 64's workspace RAM, and a little experimentation, unveils a workable (if slightly unusual) solution. Location 211 decimal (D3 hex) contains the current cursor column (or x coordinate). PEEKing this address reveals the position, returning an integer in the range 0-39. Conversely if you POKE the same address, you can specify the x coordinate of the cursor. According to the memory map, the most likely y coordinate is location 214. Sure enough, if you PEEK this location, the value returned is the current y coordinate. POKEing the same address will not take effect until the next carriage-return is encountered.

Knowing this, we now have a method of moving the cursor directly to any desired location. To shift it to location x,y (where x is in the range 0-39, and y, 1-24) simply execute the following line of code:

POKE 214,Y-1:PRINT:POKE 211,X

The PRINT statement, of course, provides the necessary carriage-return. Listing 1 illustrates the technique.

```
10 PRINT CHR$(147);CHR$(5)
20 POKE 53280,2 : POKE 53281,2
30 INPUT "ENTER A COORDINATE (X,Y)";X,Y
40 IF X>=0 AND X<=39 THEN 80
50 PRINT "ENTER X BETWEEN 0 AND 39"
60 PRINT "AND Y BETWEEN 1 AND 24"
70 PRINT : GOTO 30
80 IF Y<1 OR Y>24 THEN 50
90 PRINT CHR$(147)
100 POKE 214,Y-1 : PRINT : POKE 211,X
110 PRINT "X - MARKS THE SPOT";
120 FOR T=1 TO 3000 : NEXT T : GOTO 10
```

A simple demonstration of the PRINT AT routine.

This simple program from D J Peacock enables a 64 plus Commodore printer to double as a typewriter.

Typewriter is intended to be used for short letters which don't justify loading a fully-fledged wordprocessor. Simply use the program as if it were a typewriter; text is displayed on the screen as you type, and printed when you press RETURN or when you've reached the end of an 80 character line. If you try to enter more than 80-characters without pressing RETURN, the program will cut the input at the last complete word. When you've finished the letter, you can print as many additional copies as you wish.

An audio tone warns that you are approaching the end of a line. You can also achieve three types of emphasised print for complete lines. These are selected using the function keys as follows, and can be pressed anywhere on a line:

F1 Enhanced print
F3 Reverse characters
F5 Underline

When finished, press F7.

Lines 4-7 Program Name.

```
4 REM ****************
5 REM TYPEWRITER BY DJP
6 REM ****************
```

Lines 9-10 Set up screen colours and make all keys repeat.

```
9 DIMP$(65)
10 PRINT"■":POKE53280,6:POKE53281,6:POKE650,128:REM REPEAT ALL KEYS:0=OFF
```

Lines 20-31 Title.

```
20 PRINT"■"
30 PRINT"■              | ITC-\| T_"
31 PRINT"               ----------■"
```

Lines 40-50 Open channel to printer and set up printer.

```
40 OPEN4,4:PRINTCHR$(14):P=1
50 C$=CHR$(17)
```

Lines 60 P string holes string to be printed.

```
60 P$="":FORX=1TO90:IFX>75THENGOSUB1000
```

Lines 62 If length — 80 then back track to last word and then print out.

```
62 IFLEN(P$)=80THENGOSUB2000:PRINT#4,C$P$:P$(P)=P$:P=P+1:PRINT:GOTO60
```

Lines 65-70 Enter a character.

```
65 PRINT"■.■■";
70 GETA$:IFA$=""THEN70
```

Lines 72 Check for special characters.

```
72 IFASC(A$)=148THENA$=CHR$(20):GOSUB3000:GOTO75
```

Lines 73 Delete.

```
73 IFA$=CHR$(20)THENGOSUB3000
```

Lines 75 Return — Print that line.

```
75 IFA$=CHR$(13)ORA$=CHR$(141)THENPRINT#4,C$P$:PRINT:P$(P)=P$:P=P+1:GOTO60
```

Lines 76 f1 — Double width characters.

```
76 IFA$=CHR$(133)ORA$=CHR$(137)THENP$=CHR$(14)+P$
```

Lines 77 f3 — Reverse whole line.

```
77 IFA$=CHR$(134)ORA$=CHR$(138)THENP$="■"+P$
```

Lines 78 f5 — Underline.

```
78 IFA$=CHR$(135)ORA$=CHR$(139)THENA$=CHR$(96):P$=P$+A$:PRINTA$;:GOTO100
```

Lines 79 f7 — End type-in.

```
79 IFA$=CHR$(136)ORASC(A$)=140THEN200
```

Lines 82-100 Is the character legal? if so add it to P$.

```
82 PRINTA$;
84 IFASC(A$)=150THENP$=P$+A$:GOTO100
85 IFASC(A$)>31ANDASC(A$)<96THENP$=P$+A$:GOTO100
86 IFASC(A$)>192ANDASC(A$)<219THENP$=P$+A$:GOTO100
90 A$="":X=X-1:GOTO70
100 NEXTX
```

Lines 200-300 Print another copy.

```
200 PRINT"■PRINT DUPLICATE (Y/N)...■■"
210 POKE198,0
220 GETQ$:IFQ$=""THEN220
230 IFQ$="N"THENCLOSE4:POKE650,0:PRINTCHR$(142):PRINT"■":END
240 IFQ$<>"Y"THEN220
250 PRINT"■PRESS ANY KEY WHEN READY ...■■"
260 POKE198,0:WAIT198,1
270 FORZ=1TOP
275 PRINTP$(Z)
280 PRINT#4,C$P$(Z)
290 NEXTZ
300 GOTO200
```

Lines 1000-1040 Make a beep.

```
1000 REM POKE54276,0:POKE54277,130:POKE54278,0
1010 POKE54296,15:POKE54277,0:POKE54278,128:POKE54276,33
1020 POKE54273,75:POKE54272,150
1030 POKE54276,0:POKE54277,0:POKE54278,0
1040 RETURN
```

Lines 2000-2060 Back step to last word subroutine.

```
2000 REM P$ TOO LONG
2010 FORZ=81TO60STEP-1
2020 IFMID$(P$,Z,1)=" "THEN2040
2030 NEXTZ
2040 IFZ=80THENRETURN
2045 P$=LEFT$(P$,Z-1)
2050 FORS=1TO5:GOSUB1000:NEXTS
2055 PRINT:PRINT"■";P$;"■"
2060 POKE198,0:RETURN
```

Lines 3000 Delete subroutine.

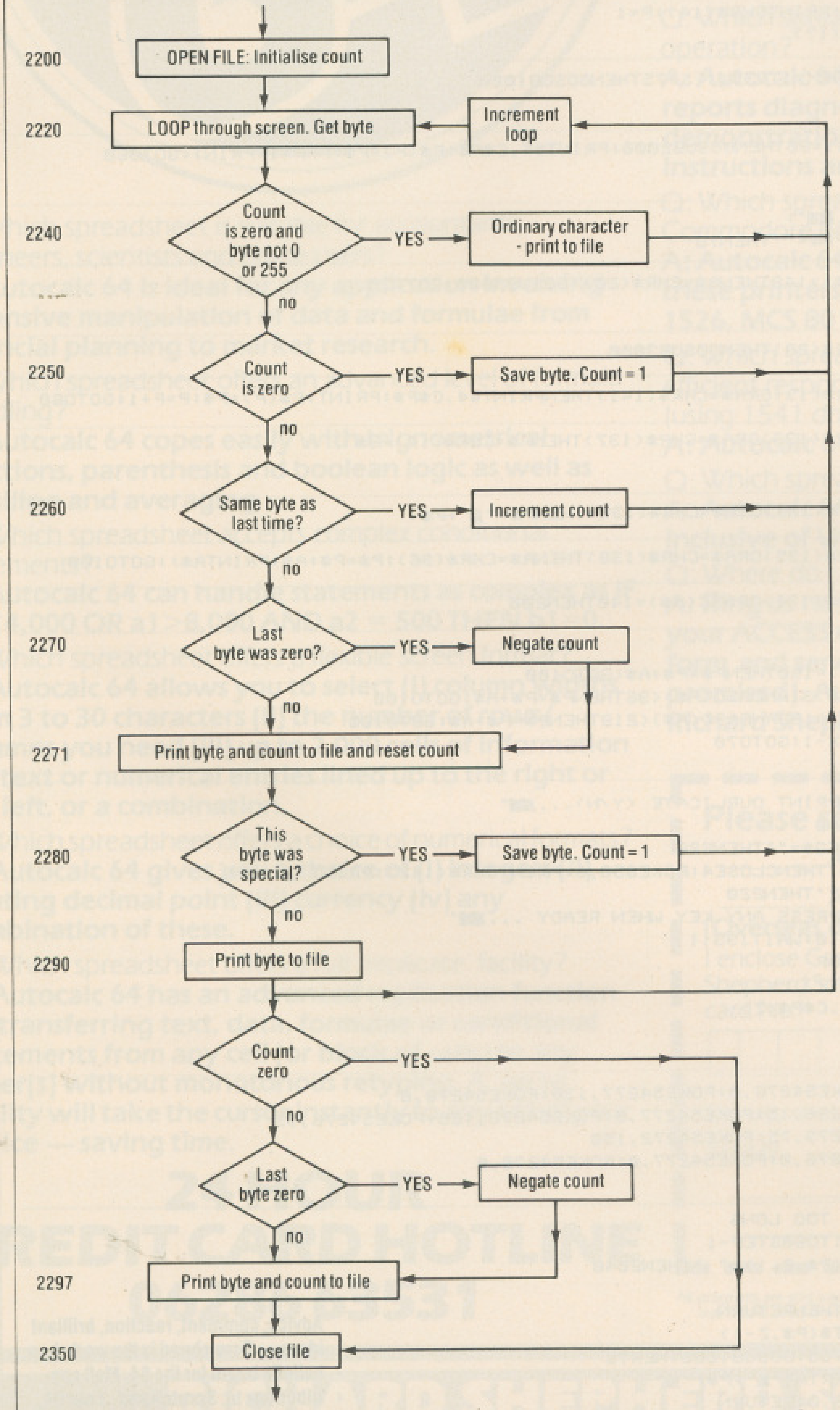
```
3000 P$=LEFT$(P$,LEN(P$)-1):RETURN
```

Advice, comment, reaction, brilliant ideas — Scratchpad is the workshop bulletin board for the 64. Mail contributions to: Scratchpad, Your 64, 14 Rathbone Place, London W1P 1DE.

NEW RESOLUTION

A perfect-fill routine, high-speed circle-plotting (using digital differential analysis) and a fast method of saving a hi-res screen to tape or disk... these are just a few of the wonders presented here by graphics guru Keith Bowden.

FIGURE 2. COMPRESSING THE BIT MAPPED SCREEN



A flowchart illustrating the technique used to compress the bit-mapped screen for efficient saving to tape/disk

In the first issue of *Your 64*, we presented two articles about high-resolution graphics. 'Firing-up Basic' included a Basic 'wedge' which added a number of hi-res commands to the standard command set, including Clear Screen, Plot Point and Draw Line, while the second article, in 'Scratchpad' gave the same set of routines in Basic.

The wedge is more convenient to use, and it's faster — being written entirely in machine-code. But the Basic routines are easier to understand and thus more easily modified by the user. This month, we'll extend that set to include routines to draw circles and to fill (paint) areas of arbitrary shape and colour. We also include some very efficient routines to save the high-resolution graphics screen to tape or disk, and restore it again later. All the subroutines listed can be called from your own programs.

The circle routine is very efficient, but still rather slow because all the points are plotted using a Basic routine. By calling the point-plotting routine @PLOT given in the 'Firing-up Basic' article, however, this can be speeded up considerably. In fact, it then draws circles nearly as fast as many other microcomputers do in machine-code! The fill routine is very slow — the example given takes about 30 minutes — but it is a *perfect* fill routine and *never* misses a point. Again, it can be speeded up by calling @PLOT, but it's still quite slow (remember, it's doing a lot of work).

If you don't think people are going to sit patiently for half an hour while you fill in the moonscape to your moon-lander program, an alternative, fast fill routine is the better option. However, the price of this speed is that a number of attempts may be necessary to fully paint an arbitrary area; for most applications, this is a small price to pay.

The Save and Restore picture routines use a very efficient screen compression technique, taking around five minutes to save or restore a simple high resolution graphics screen to tape — and a lot less to disk. For more complicated screens, it's faster to use a block memory save. The routines listed are written in Basic; converted to machine code, they'll be as efficient as any available — and considerably better than most.

In the routines presented here, we've opted to leave Basic in Bank 1 of the 64's memory, and move the high resolution screen up to Bank 2. High-resolution bit-mapped graphics mode displays 200 rows of 320 pixels and only two colours are allowed in each 8*8 pixel character square. Thus a screen of high-resolution graphics takes 320*200/8=8000 bytes of RAM. The colour area is within the 16K area used by the VIC chip, and takes 40*25=1000 bytes. The usual 'colour nibble area' is not used. This allows each character square to have an independent foreground and background colour, and stops the colours scrolling with the text screen.

Each pixel on the screen corresponds to a bit in memory. If the bit is set to 1, the pixel is set to the foreground colour for that character square, as defined by the upper

THE LISTING CONTAINING ALL THE ROUTINES DESCRIBED.

First an example
Lines 10-110 Lets's take a look at the demonstration program. This switches to high-resolution bit-mapped graphics mode and draws four small circles (radius 10 pixels) — arranged in a square and surrounded by a larger circle. It then proceeds to paint the larger circle brown, leaving the smaller circles orange. As the 64 allows two colours in each 8×8 pixel character square, their background colour changes to orange as the picture is drawn in brown. Finally, when every pixel has been found, it switches back to text mode.

Plot a circle
Lines 60100-60160 To use this routine, set X0 and Y0 to the x and y co-ordinates of the centre of the circle and R to the radius, then use GOSUB 60100. This tiny routine uses a technique known as digital differential analysis, where the value of each new pixel to be plotted is calculated from the previous one. The circumference of the circle is $2\pi R$, and the 'step length', E, is set to 1/R. This guarantees that the circle is continuous, that no points are missed out and that no two points are plotted twice. When translating this routine into machine code, the step length may be reduced to a value $E=2^2-N$, where N is an integer. This reduces the multiplications in line 60130 to shift operations which are very efficient in machine code.

Plot a point
Lines 60170-60330 To use this routine, set X and Y to the x and y co-ordinates of the point to be plotted. Then s... A and B to the foreground and background (paper and ink) colours required, and C and F as follows:

- C=0 Do not change paper and ink colours of the current character square
- C=1 Set foreground colour only
- C=2 Set background colour only
- C=3 Set both colours.

- F=1 Erase the current point (set to background colour)
- F=0 Invert the pixel (if set then erase it, if not then set it)
- F=1 Plot pixel (set to current foreground colour)
- F=2 Move to the point, leaving the pixel unchanged

Once you've set the six variables, use GOSUB 60170. Points outside the valid screen co-ordinates are ignored. XH, YH, XL, and YL are the high and low bytes of the x and y co-ordinates respectively (see figure 1). Line 60270 picks the corresponding byte, P, out of screen memory.

Switch to text
Line 60390
Usage: GOSUB 60390

```
1 REM"h=SAVE"@0:YOUR 64 2",8
10 DIM X%(1000),Y%(1000),K%(1000)
30 FORI=1TO200:K%(I)=0:NEXT
50 F=1:A=8:B=9:C=3:POKE 53280,1:GOSUB604
00:GOSUB60350:GOSUB60370
60 X0=100:Y0=100:R=30:GOSUB60100
70 X0=112:Y0=112:R=10:GOSUB60100
80 X0=112:Y0= 88:R=10:GOSUB60190
90 X0= 88:Y0=112:R=10:GOSUB60100
100 X0=88:Y0= 88:R=10:GOSUB60100
110 I=1:X%(1)=100:Y%(1)=100:GOSUB60010:G
OSUB60390:END

60000 REM *** FILL ROUTINE **************
60010 IFI=0THENRETURN
60020 X=X%(I):Y=Y%(I):GOSUB60940:IFLO<>0
AND(K%(I)=0)THENI=I-1:GOTO60050
60030 IFLO<>0THEN60050
60040 X=X%(I):Y=Y%(I):GOSUB60180
60050 IFK%(I)=0THENX%(I+1)=X%(I)+1:Y%(I+
1)=Y%(I):K%(I)=1:I=I+1:K%(I)=0:GOTO60010
60060 IFK%(I)=1THENX%(I+1)=X%(I):Y%(I+1)
=Y%(I)-1:K%(I)=2:I=I+1:K%(I)=0:GOTO60010
60070 IFK%(I)=2THENX%(I+1)=X%(I)-1:Y%(I+
1)=Y%(I):K%(I)=3:I=I+1:K%(I)=0:GOTO60010
60080 IFK%(I)=3THENY%(I+1)=Y%(I)+1:X%(I+
1)=X%(I):K%(I)=4:I=I+1:K%(I)=0:GOTO60010
60090 IFK%(I)=4THENI=I-1:GOTO60010

60100 REM ******************************
60110 X1=R:Y1=0:E=1/R:REM CIRCLE
60120 FORTH=0TO2*π*R
60130 X1=X1+E*Y1:Y1=Y1-E*X1
60140 X=X1+X0:Y=Y1+Y0:GOSUB60180
60150 NEXTTH
60160 RETURN

60170 REM ******************************
60180 IFX<0THENRETURN:REM PLOT A POINT
60190 IFX>319THENRETURN
60200 IFY<0THENRETURN
60210 IFY>199THENRETURN
60220 XI=INT(X):YI=INT(Y)
60230 XH=8*INT(XI/8):YH=8*INT(YI/8)
60240 IFF=2GOTO60310
60250 XL=7+XH-XI
60260 YL=YI-YH
60270 P=24*1024+YL+XH+YH*40
60280 IFF=1THENPOKEP,(PEEK(P))OR(2↑XL)
60290 IFF=-1THENPOKEP,(PEEK(P))ANDNOT(2↑
XL)
60300 IFF=0THENPOKEP,(PEEK(P)ANDNOT(2↑XL
))OR(NOTPEEK(P)AND(2↑XL))
60310 IFC=0THENGOTO60330
60320 GOSUB60420
60330 RETURN

60340 REM ******************************
60350 FOR I=16*1024TO17*1024-1:REM CLEAR
 COLOUR
60360 POKE I,1:NEXTI:RETURN

60370 FOR I=24*1024TO32*1024-1:REM CLEAR
 SCREEN
60380 POKE I,0:NEXTI:RETURN

60390 POKE56576,151:POKE53272,21:POKE532
65,27:RETURN:RFM SWITCH TO TEXT

60400 POKE 56576,150:POKE 53272,8:POKE53
265,59:RETURN:REM SWITCH TO GRAPHICS

60410 REM ******************************
60420 BYTE=16*1024+YH*5+XH/8:REM SET COL
OURS
60430 IFC=1THENPOKEBY,(PEEK(BY)AND240)OR
A:RETURN
```

A perfect fill
Lines 60000-60090 To use our Perfect Fill routine in your own program, set the variables X and Y to the x and y co-ordinates of a point in the middle of the region to be filled, and then use GOSUB 60000. Some people might like to set a variable FILL=60000 at the beginning of their program, and then use GOSUB FILL. The routine is an iterative implementation of the standard recursive fill routine.... and it calls itself. It checks to see if the point X,Y is set (i.e. if the pixel is lit); if not, it first sets it and then attempts to propagate itself by taking a step N, S, E and W, respectively, calling itself on each occasion.

The arrays X% and Y% hold the x and y co-ordinates of each point visited, and K% holds a number from 0 to 4, showing which directions have been searched. The 'stack pointer', I, tells the program how many points it currently has to remember. Thus the routine knows the bits it's missed out when filling a complicated region, and will go back and fill them later. During the periods when it's 'checking back', looking for the areas that have been missed, it will stop plotting for considerable periods of time. Remember, the routine will switch back to text mode only after completing the fill, so you'll know when it's finished.

Perfect fill is known as a 'four connected' fill routine, since it steps in four directions, but will fill an 'eight connected' area — that is, one in which the boundary pixels are diagonally adjacent, rather than vertically and horizontally. If the region is not completely surrounded by lit pixels connected in this way, however, the fill will leak out of the boundary into the surrounding area.

Clear colour RAM
Lines 60340-60360 Usage: GOSUB 60340. This clears background colour to white and foreground colour to black.

Clear bit mapped screen
Lines 60370-60380
Usage: GOSUB 60370

Switch to Bank 2 high-resolution graphics
Line 60400 Usage: GOSUB 60400. Both this and the above routine are useful in direct mode when debugging programs.

Set colours
Lines 60410-60450
This is called by the point-plotting routine. Note that 'ANDing' a value with 240 picks out the high nibble, while 15 picks out the low nibble.

NEW RESOLUTION

```
60440 IFC=2THENPOKEBY,(B*16)OR(PEEK(BY)A
ND15):RETURN
60450 IFC=3THENPOKEBY,B*16+A:RETURN
```

Save colour RAM to cassette
Lines 60460-60500 Usage: GOSUB 60460. The file name used is "COLOR".

```
60460 REM ******************************
60470 OPEN 1,1,1,"COLOR":REM SAVE COLOUR
60480 FOR I=1024*16TO1024*17-1
60490 PRINT#1,PEEK(I)
60500 NEXT I:CLOSE1:RETURN
```

Restore colour RAM from cassette
Lines 60510-60550
Usage: GOSUB 60510. Rewind the cassette deck to start of "COLOR" file before use.

```
60510 REM ******************************
60520 OPEN 1,1,0,"COLOR":REM LOAD COLOUR
60530 FOR I=1024*16TO1024*17-1
60540 INPUT#1,Q:POKE I,Q
60550 NEXT I:CLOSE1:RETURN
```

Save bit mapped screen to tape
Lines 60560-60710
Usage: GOSUB 60560. To save a bit mapped screen to tape or disk, it's necessary to store around 9K of memory, including colour RAM. Performing a hexadecimal dump takes around a minute onto disk or seven minutes to tape, with a similar amount of time to restore the screen. My original program wrote decimal numbers to tape and took over fifteen minutes to save a picture! As these times are inconveniently long, it's worth looking at ways to compress the data.

The algorithm used assumes that the picture you are saving is relatively simple, and hence contains long sequences of bytes set to either 0 or 255. Any values other than these are saved as their ASCII equivalents, taking up the same amount of storage as they would from a hexadecimal dump. When a value of 0 or 255 is encountered, the algorithm counts the number of consecutive 0s (or 255s) in the screen area and saves a byte of value 255 — followed by an integer containing the number of consecutive identical bytes counted. This count is set positive for 255s and negative for 0s. Note that zero (null) bytes cannot be saved to serial files as they are used as the end of record terminator. (Actually they can be saved but not read back from Basic.) A flow chart of this data compression method is shown in Figure 2.


```
60560 REM ******************************
60570 OPEN 1,1,1,"PICTURE":REM SAVE SCRE
EN
60580 CO=0
60590 FORI=1024*24TO1024*32-1
60600 A%=PEEK(I)
60610 IFCO=0ANDNOT(A%=0ORA%=255)THENPRIN
T#1,CHR$(A%);:GOTO60680
60620 IFCO=0THENB%=A%:CO=1:GOTO60680
60630 IFA%=B%THENCO=CO+1:GOTO60680
60640 IFB%=0THENCO=-CO
60650 PRINT#1,CHR$(255);CO:CO=0
60660 IFA%=0ORA%=255THENB%=A%:CO=1:GOTO6
0680
60670 PRINT#1,CHR$(A%);
60680 NEXTI:IFCO=0GOTO60710
60690 IFB%=0THENCO=-CO
60700 PRINT#1,CHR$(255);CO
60710 CLOSE1:RETURN
```

Load bit mapped screen
Lines 60720-60800 Usage: GOSUB 60720.

```
60720 REM ******************************
60730 OPEN1,1,0,"PICTURE":REM LOAD SCREE
N
60740 FORI=1024*24TO1024*32-1
60750 GET#1,A$:IFA$=""GOTO60750
60760 A%=ASC(A$)
60770 IFA%<>255THENPOKEI,A%:GOTO60800
60780 INPUT#1,CO:IFCO<0THENCO=-CO:A%=0
60790 FORJ=1TOCO:POKEI+J-1,A%:NEXTJ:I=I+
CO-1
60800 NEXTI:CLOSE1:RETURN
```

Get a pixel
Lines 60930-61000 Usage: set X and Y to the x and y co-ordinates of the point to be tested and GOSUB 60930. If the pixel is set, the variable LO is returned with a non-zero value otherwise it's zero.

Finally, our version here of the famous Roses program uses many of the routines shown above

```
60810 REM ******************************
60820 XD=1:REM FAST FILL ROUTINE
60830 XREF=X:YREF=Y
60840 GOSUB60940
60850 GOSUB60420
60860 IFXD=1THENIFX=XHANDPEEK(P)=0THENPO
KEP,255:X=X+8:GOTO60840
60870 IFXD=-1THENIFX=XH+7ANDPEEK(P)=0THE
NPOKEP,255:X=X-8:GOTO60840
60880 IFLO=0THENPOKEP,(PEEK(P))OR(2↑XL):
X=X+XD:GOTO60840
60890 XD=-XD:X=XREF:IFXD=-1GOTO60840
60900 X=X+1:Y=Y+1:GOSUB60940
60910 IFLO=0THENPOKEP,(PEEK(P))OR(2↑XL):
X=X+XD:GOTO60840
60920 X=XREF:Y=YREF:RETURN
```

Fast fill routine
Lines 60810-60920 Usage: set X and Y to a point just below the top centre of the boundary and use GOSUB 60810. This routine may have to be called a number of times for complicated shapes. The algorithm works vertically downwards from the start point, searching left and right for set pixels as it goes. It's particularly fast as it sets pixels in blocks of one byte at a time whenever it can. If the shape has more than one upper point, you'll need to call the routine more than once (see Figure 3).

```
60930 REM ******************************
60940 XH=8*INT(X/8):REM GET A PIXEL
60950 YH=8*INT(Y/8)
60960 XL=7+XH-X
60970 YL=Y-YH
60980 P=24*1024+YL+XH+YH*40
60990 LO=(PEEK(P))AND(2↑XL)
61000 RETURN
```

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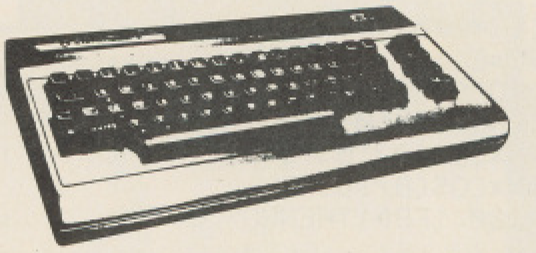
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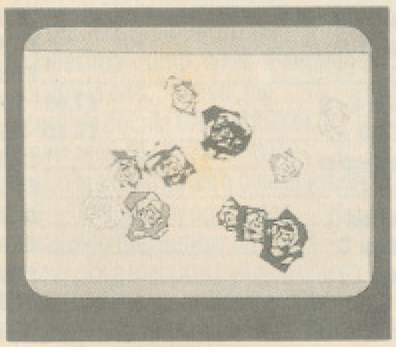
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NEW RESOLUTION


```
10 POKE 56576,150:POKE 53272,8:POKE 5326
5,59
20 GOSUB1100:GOSUB1200
100 FORA=2TO15
105 XB=0:YB=0
110 D=RND(1)*260+30:E=RND(1)*140+30
120 F=RND(1)*200+300
125 XC=D:YC=E
130 FORB=1TOFSTEP4
140 M=(B/(RND(1)*10+10))
170 X=0.7*M*SIN(B/16)+D
180 Y=0.7*M*COS(B/16)+E
190 GOSUB7000:IFB>1THENGOSUB8000
200 NEXTB,A
1000 X%=X:Y%=Y
1010 YH=8*INT(Y%/8):XH=8*INT(X%/8)
1020 XL=7+XH-X%
1030 YL=Y%-YH
1040 P=24*1024+YL+XH+YH*40
1050 POKEP,(PEEK(P))OR(2↑XL)
1060 POKE16*1024+YH*5+XH/8,1+A*16
1070 RETURN
1100 FOR I=16*1024TO17*1024-1
1110 POKE I,1:NEXTI:RETURN
1200 FOR I=24*1024TO32*1024-1
1210 POKE I,0:NEXTI:RETURN
1300 POKE56576,151:POKE53272,21:POKE5326
5,27:RETURN
7000 XA=XB:XB=XC:XC=X:X1=XA:X2=XB:X3=XC
7010 YA=YB:YB=YC:YC=Y:Y1=YA:Y2=YB:Y3=YC
7030 RETURN
8000 REM TRIANGLE FILL
8020 IFY2<Y1THENT=Y1:Y1=Y2:Y2=T:T=X1:X1=
X2:X2=T
8030 IFY3<Y2THENT=Y2:Y2=Y3:Y3=T:T=X2:X2=
X3:X3=T
8050 IFY2<Y1THENT=Y1:Y1=Y2:Y2=T:T=X1:X1=
X2:X2=T
8100 M1=(Y2-Y1)/(X2-X1):C1=Y1-M1*X1
8110 M2=(Y3-Y2)/(X3-X2):C2=Y2-M2*X2
8120 M3=(Y3-Y1)/(X3-X1):C3=Y3-M3*X3
8125 SP=1:IFX2>(Y2-C3)/M3THENSP=-1
8130 FORY=Y1TOY2
8140 FORX=(Y-C1)/M1TO(Y-C3)/M3STEPSP
8150 GOSUB1000:NEXTX,Y
8160 FORY=Y2TOY3
8170 FORX=(Y-C2)/M2TO(Y-C3)/M3STEPSP
8180 GOSUB1000:NEXTX,Y
8190 RETURN
```



Our version of the famous Roses program. It makes use of many of the routines we've seen in this article.

nibble (top four bits) of the corresponding byte in colour RAM; if set to 0, the pixel is set to the background colour for that character square, as defined by the value of the lower nibble of the corresponding byte in colour RAM.

The way in which the screen is mapped to RAM is very simple once you've got the hang of it. The first 320 bytes of the 8K screen area defines what will appear on the top row of 8*8 pixel blocks (character squares). The second 320 bytes defines the second row of character squares, and so on. Each row is mapped such that the first character square in the row is defined by the first eight bytes in the associated 320-byte block, the second character square is defined by the second eight bytes, and so on. For each character square the first byte defines the first row of eight pixels, and the second byte, the second row and so on — exactly as with character memory. Thus in high-resolution mode, every character square can display a different character or graphic symbol; we're not limited to 256 different symbols as we are in text mode.

Colour RAM is mapped to the screen in an equally straightforward manner, each byte defining the foreground and background colour of a character square as described above. The first 40 bytes define the colours of the first row of characters on the screen, the second 40 bytes the colours of the second row, and so on.

Routine Breakdown

The routines below can all be used from your own programs by simply setting the values of the relevant variables, notably X and Y, and calling the appropriate subroutine. The plotting routine is particularly powerful, as it not only lets you draw in normal, erase or invert mode, but also lets you define which of the pen and ink colours you wish to change while plotting.

Parts of this article were adapted from Chapter 5 of The Companion to the Commodore 64, *written by our author here*.

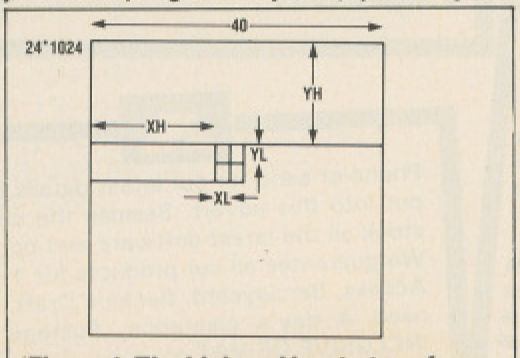


Figure 1: The high and low bytes of the x and y coordinates

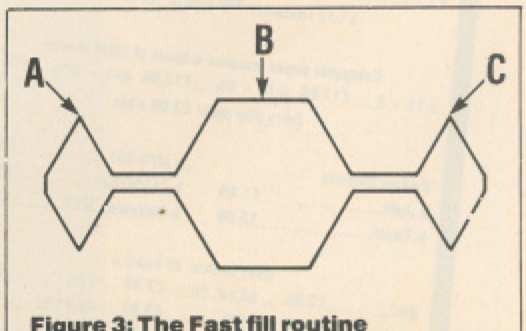


Figure 3: The Fast fill routine would require three separate starting points to fill this shape — A, B and C

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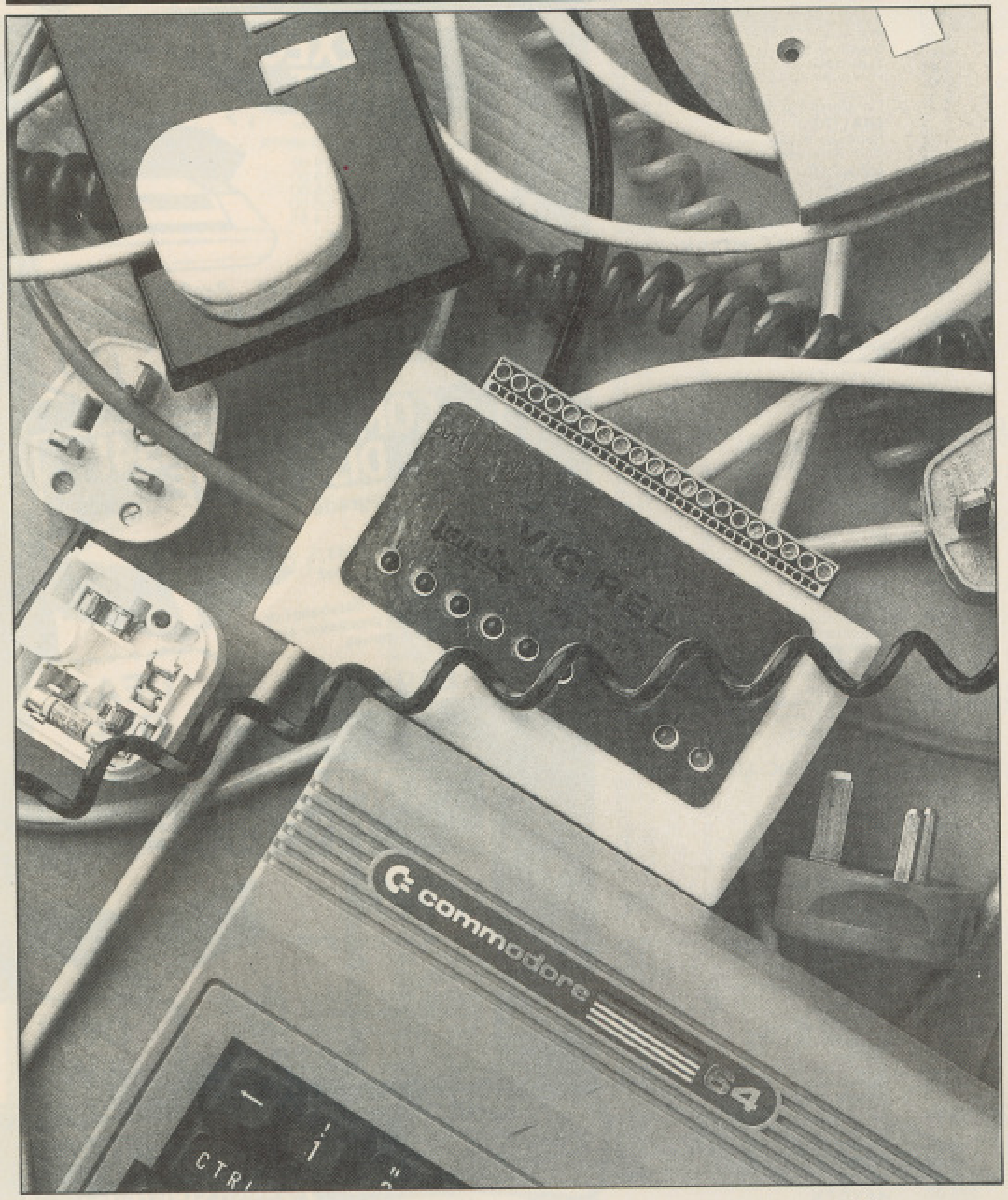
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CONTROLLING INTERESTS



The VIC-REL cartridge claims to make it easy to control doors, train-sets and other electrical devices with your 64.
Clive Embrey *tries to keep burglars at bay while he tests it.*

The VIC-REL cartridge is a control unit suitable for use with both the 64 and VIC-20. The unit attaches to the user port and provides six output relays (switches) and two input optometers (sensors). The 5-volt supply available at the port is carried through to the connection terminals at the edge of the unit. Each output relay has its own red LED which lights when the relay is closed. Similarly, the green input LEDs are lit when 5-12 volts DC is connected. A schematic representation of VIC-REL is shown in Figure 1.

When closed, the output relays are electrically isolated from the micro and are maximum rated at 24 volts, 10 amps (240 watts). The inputs are maximum rated at 50mA. If you intend to control devices in excess of these ratings, then you'll have to use suitable secondary power relays *which must be 'fail-safed'* with respect to your computer. If this precaution is not taken, and the full load is allowed to pass into the VIC-REL, the next connection you make will be with your bank manager — for a loan to buy a new micro! When higher loads are involved, the output circuits are used indirectly to activate the power relays, rather than being used for direct control.

The warning about high loads is given on the last page of the manual. In my opinion, it should be on the first. It's easy to envisage the disasters as the more head-strong among us dive straight in without reading the whole manual (a phenomenon not entirely unheard of).

Read All About It

The manual is easy to follow and contains all that's necessary for using VIC-REL. Although the cartridge works with both the VIC-20 and 64, reference is made only to the VIC. This, I'm reliably informed, is because in Sweden (where the VIC-REL is made) the 64 is known as the VIC-64. I suspect that the manual is a direct translation from the Swedish: it certainly doesn't scan too well in one or two places. In comparison to some English manuals, however, it rates an alpha plus! Note that if you're using the unit with a 64 rather than a VIC-20, it's important to read the last page of the manual first(!); that's where it tells you which user port registers you should use.

I've noticed a few errors in the manual, some of which could easily frustrate a beginner. For instance, the test program lights each LED in turn and leaves only relay 6 closed — which is not what you're told. And the line reading POKE 37163,PEEK(37163) AND 8 has two digits transposed ... it should be POKE 37136. Another point to watch (on the 64 at least) is that all references to inputs 1 and 2 should be transposed; input 1 occurs on bit 7 and input 2 on bit 6.

In Detail

(The following is specific to the 64, but VIC users shouldn't have too much difficulty relating/translating it to their machine.)

VIC-REL connects to the user port — the one which allows the 64 to talk to the outside world (potential users are advised to read the input/output guide (Chapter 6) and Appendix M of the Programmer's Reference Guide, if they haven't already done so).

The 64 has two 6526 Complex Interface Adapator chips (CIAs). These are used throughout the machine for input/output operations and are connected to the user port as port A and port B. The 64 allows the user to control CIA B (port B). As well as providing suitable data lines for RS232 communication (printers, modems, etc.), eight data lines are available (PB0-PB7 pins C-L) for I/O. These lines are all provided from the data port B data register ($DD01/56577). A second register, the data direction register ($DDO3/56579), allows the user to configure any or all of the lines as either input or output. If a bit of this register is set to 1 (one), the corresponding line is set up as output. If set to 0 (zero), then it's an input. Control of the VIC-REL cassette takes place through these registers.

The Basic binary operators, AND, OR, NOT and '=' are used to implement the desired action by setting the appropriate bits of $DDO3. To fully initiate the unit you have to configure bits 0 to 5 as outputs (1) and bits 6 and 7 as inputs (0). The resulting value to be POKEd is 00111111 binary or 63 decimal. The user may then read $DD01 to test for inputs and set up the desired output circuits.

An output relay is closed by setting the corresponding bit in $DD01. These are:

BIT	7	6	5	4	3	2	1	0	
OUTPUT			6	5	4	3	2	1	
POKE $DD01			32	16	8	4	2	1	to close

For example, POKEing $DD01 with 17 (16+1) will close relays 5 and 1 only. To open all relays, simply POKE $DD01 with zero. To open a specific relay, leaving all other relays in their current state, only the specific bit must be altered. This is easily

accomplished by PEEKing $DD01, ANDing with 255-2 (relay no.-1) and POKEing in the resulting value. The reverse process of closing a specified relay can be accomplished by ORing the same value.

The status of the inputs are determined by reading bit 6 and 7. (As mentioned earlier, inputs 1 and 2 are transposed on the 64, so bit 7 relates to 1, and bit 6 to 2.) When input 1 has 5-12 volts, bit 7 is zero; when it loses this voltage, it's set to 1. Input 2 is similar, but with bit 6 being changed. You can easily test for this in Basic as follows:

(PEEK($DD01) AND 128)=128 when input 1 at 5-12 volts
(PEEK($DD01)AND 128)=0 when input 1 loses voltage
(PEEK($DD01)AND 64)=64 when input 2 at 5-12 volts
PEEK($DD01)AND 64)=0 when input 2 loses voltage

Control is therefore exercised by a series of simple PEEKs and POKEs, with the comforting thought that the appropriate LED will light or go out to let you know all is well. As all the operations are carried out in a bit-wise fashion, it's extremely simple to write the control program in machine code. The advantage of this is that it allows control to be carried out in the background, while the computer is being used to perform other tasks: for instance, the interrupt vector being patched to include the control routine and remembering to end the control routine with a JMP to continue the normal interrupt.

The manual contains a program for the control of a motorised door, activated by a bell push. This is illustrative only, and can be followed through to see how to write the necessary code. The disadvantage of the particular example chosen is that the motors would need to be rated above the maximum of the unit, so much of the control will be indirect. Those trying something of this nature as a first attempt are going to have to know quite a bit about power relays. I thought, therefore, it would be a good idea to devise a simple arrangement which anyone could set up immediately, using only a minimum of components and knowledge of electronics. To do this, all devices had to be rated below 240 watts, and preferably DC. I came up with a simple burglar alarm system; it's not intended for serious use, but it does give a practical example of the way in which the unit can be used.

VIC-REL In A Working System

The ancilliary hardware you'll need for this little operation consists of a portable cassette running off DC batteries; a bell (in my case, the front door bell); two spring plate switches; and a length of one- or two-core cable. Figure 2 shows the circuits I used.

The idea behind the alarm was to wire up two of the house doors, and let the system tell me whether either had been opened. Were this to be the case, the cassette would theoretically start playing some off-putting noises... the one I settled for was a recording of the barking of our dog as the cat sunk its claws into his neck! It proved difficult to keep the dog barking for the full 7½-minute side of the cassette, so in the end I made up a short loop of tape on the cassette, which repeated his less than enthusiastic cries. I also wired the door bell to ring.

To avoid burning out anything, I wrote the program so that it would cut out five minutes after initiating an alarm; any burglars would presumably have been long gone — or they'd have had the common-sense to turn the computer off. I also considered using more than two switches, which would mean wiring a number of them in series onto one of the in[illegible] break anywhere in the circuit i[illegible] enough reason to trigger the relays. ... sound facilities of the SID chip also crossed my mind.

With the length of wiring I was using, I found the 5-volt supply on the 64 adequate. However, I did experiment over greater distances and found it necessary then to use an independent power supply.

The program I wrote to control the system is given here (see Listing 1). The self test was included because one of the switches I used tended to stick, and on

WAKE UP WITH VIC-REL

140	DATA REGISTER PORT B	`140 DRB=56577`
150	DATA DIRECTION REGISTER	`150 DDR=56579`
160	INIT I/O	`160 POKE DDR,63`
170	ALL OUTPUTS OFF	`170 POKE DRB,0`
180	ASSUMES ALL DOORS ETC. CLOSED	`180 INPUT "RUN SELF TEST";Y$`
190	NO TEST	`190 IF Y$="N" GOTO 460`
230	PLAY MUST BE ON	`230 PRINT "TESTING CASSETTE"` `240 GOSUB 1000`
250	CLOSE RELAY 1	`250 POKE DRB,1` `260 GOSUB 2000`

270	OPEN RELAY 1	`270 POKE DRB,0`
		`280 PRINT "TESTING BELL"`
		`290 GOSUB 1000`

300	CLOSE RELAY 2	`300 POKE DRB,2` `310 GOSUB 2000`

320	OPEN RELAY 2	`320 POKE DRB,0`
		`330 PRINT "TESTING ALARM SWITCHES"`
		`340 GOSUB 1000`
		`350 PRINT "BREAK CIRCUITS BY OPENING DOORS"`

360	SET TO FAILED	`360 S1$="FAILED":S2$=S1$`
		`410 IF (PEEK(DRB) AND 128)=128 THEN S1$="OK"`
		`420 IF (PEEK(DRB) AND 64)=64 THEN S2$="OK"`

430	CYCLE TO ALLOW ALL DOORS OPEN	`430 GET Y$:IF Y$="" GOTO 410`
		`440 PRINT "CIRCUIT 1";S1$`
		`450 PRINT "CIRCUIT 2";S2$`
		`500 INPUT "DELAY BEFORE ACTIVATING ALARM IN MINS";D`

510	INIT TIME	`510 TI$="000000"`
520	WAIT FOR IT	`520 IF VAL(TI$)<D*100 GOTO 520`
560	ALARM	`560 IF (PEEK(DRB) AND 128)=128 GOTO 590`
570	ALARM	`570 IF (PEEK(DRB) AND 64)=64 GOTO 590` `580 GOTO 560`
620	CLOSE RELAYS 1 AND 2	`620 POKE DRB,3` `630 TI$="000000"`
640	LET RUN 5 MIN	`640 IF VAL(TI$)<500 GOTO 640`

650	ALL OFF	`650 POKE DRB,0`
		`660 END`
		`1000 :REM TEST MESSAGES`
		`1010 PRINT "PRESS A KEY TO START"`
		`1020 GOSUB 2000`
		`1030 PRINT "PRESS A KEY TO STOP"`
		`1040 RETURN`
		`2000 :REM WAIT FOR A KEY`
		`2010 GET Y$:IF Y$="" GOTO 2010`
		`2020 RETURN`

Listing 1: a simple burglar-alarm system. Lines 140 & 150 define the data-register variables, 236-360 perform the self-test and 500 onwards is the alarm program itself.

CONTROLLING INTERESTS

one occasion I put in the wrong cassette. (The sound track from *Attack of the Mutant Camels* was not likely to frighten anyone!) The self test allowed me to go round opening all the doors involved, returning to the 64 to see if the switches had opened. A final touch was to set up a delay before the system was activated — to allow time to get out of the house without setting off the alarm. I didn't bother with a delay on re-entering, simply accepting that the alarm would start.

The system is not what one would call 'professional'. It had many weak points — not least of which are the use of mains power supply, and the ease with which the computer can be disabled. If I had an auto-dial phone, I'd have tried to activate it to call me wherever I happened to be — to warn me of the illegal entry.

Last Word

The VIC-REL was fun and easy to use. Though I personally didn't have any practical application for it (my 64 is usually required for other purposes) I could see its value in introducing the concepts of computer control. I'm sure it would make a useful addition to any school computing department, and at £35, it has to be good value for hobbyists who want to do something a little out of the ordinary with their machine.

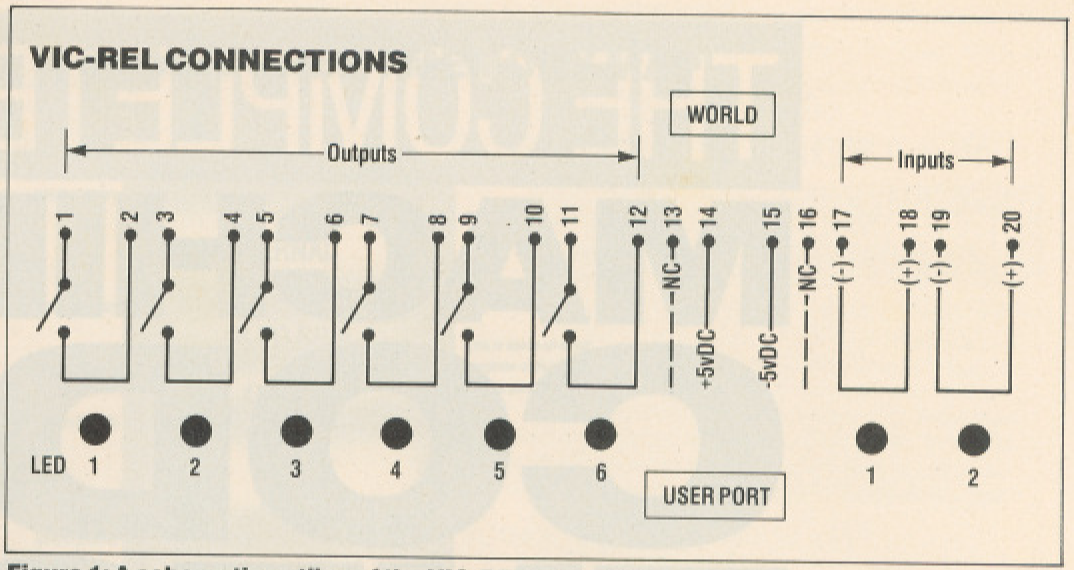


Figure 1: A schematic outline of the VIC-REL cartridge.

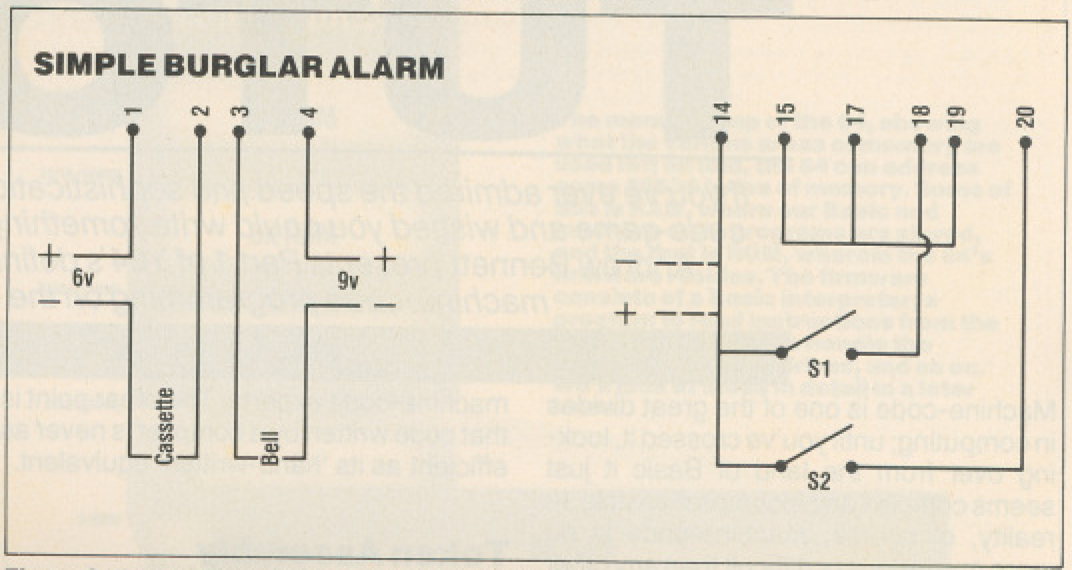


Figure 2: the alarm system used to test the device.

THE COMPLETE Y64 MACHINE CODE TUTOR

If you've ever admired the speed and sophistication of a machine-code game and wished you could write something like it, read on. Andrew Bennett *presents Part 1 of Y64's definitive guide to machine-code programming on the 64.*

Machine-code is one of the great divides in computing; until you've crossed it, looking over from the land of Basic it just seems complex and incomprehensible. In reality, of course, machine-code is no more mysterious or difficult than any other form of programming — once you've got the hang of it. Over the next five or six issues I'll be taking you from the building blocks of basic machine-code concepts, right through to writing action games. I don't assume any prior knowledge of machine-code, and everything will be approached by way of practical examples, using Basic as a reference point. This month, we'll start by discussing what we mean by machine-code.

Numbers, Just Numbers

Have you ever looked nervously at the long list of numbers at the end of some programs, only to be told that these are machine-code? Well... don't worry. However little they mean to us humans, they *do* mean something to the computer. If we had to work in these numbers in order to write machine-code programs (as our predecessors did) we'd never get anything finished. Fortunately, that's no longer the case. Each number means something... some of them are variables, some are constants and the rest are instructions (just as PRINT is an instruction in Basic).

Assembly (or assembly language) was invented to make things easier for us humans, and it's the language in which most machine-code programs are now written. It's also possible to write machine-code programs in a high level language like Basic or Pascal, and have them compiled (converted) into machine-code by a program known as a compiler. That's not something we shall be investigating; anyone can use compilers and the object here is to turn you all into machine-code experts. The other point is that code written by a compiler is never as efficient as its 'hand-written' equivalent.

Token Assembly

Assembly language allows us to write machine-code programs, not by means of the numbers that the computer works in, but using instead variables and instructions known as tokens. These are much easier to understand.

> **PART 1: GROUNDRULES**
>
> - Assembly — a system of tokens that takes the strain out of writing in machine-code
> - The advantages that machine-code offers over a high level language like Basic.
> - Hexadecimal — the numeric system often used in assembly language.
> - Converting between hexadecimal and decimal systems.

To write programs in assembly language, we need an assembler. That's a program that takes your assembly language program and converts it into machine-code. But, you may ask, isn't this the same as a compiler? No — a compiler converts *high level* language code *permanently* into machine-code; thus compilation is a once-only process. An assembler, in contrast, converts *assembly language* code into machine-code, *token by token.* All the assembler does is to change a number's token into the number itself. Some assemblers change your programs into machine-code as you type them in... others only make the conversion when you've finished.

Assemblers range in price from eight to around sixty pounds and, in most cases, you get what you pay for. And in the same way that computers often differ in the way they handle Basic, so most assemblers have their own way of doing things. In this series I'll be trying to generalise as much as possible where assemblers are concerned; next month I'll be reviewing several 64 assemblers, to allow you to compare features. My feeling is that, once you're convinced about the advantages of machine-code, you should go out and buy the best assembler that you can afford. Remember that an assembler is a tool, just like Basic. Buy a poor assembler and you won't be writing your programs anything like so easily or quickly as you could with something better.

Speedy And Compact

Learn machine-code and you're learning your machine's native tongue. Overall, there are three powerful reasons why you should take the trouble:

1. It's much faster than any other language; the speed is such that it gives the illusion that dozens of things are happening at once — whereas in reality they are just being carried out one after the other, very quickly.
2. Machine-code programs use much less memory than their Basic counterparts.
3. Only with machine-code can you fully come to terms with the latent power of your 64.

The Basic interpreter resident in the 64's ROM is itself a machine-code program and, given that, you might wonder why Basic doesn't run as quickly as machine-code. To answer this, let's examine what happens when we run a

Basic program. To begin with, it searches for the first instruction (which might, for instance, be PRINT). It realises that PRINT is one of its keywords, and searches a table to find the machine-code program that performs PRINT. When it finds the PRINT program, it prints the necessary words and letters to the screen and then searches for the next instruction in the program.

All this searching takes a fair amount of time, and it's a procedure which must be performed for every keyword in the program. Machine-code programs, in contrast, are written to do one task alone, and they flow in a more orderly fashion from one to the next, with no time wasted.

To illustrate the point, type in Listing 1. This Basic program fills the screen with yellow 'A's. If you have a stopwatch, try timing it. You'll find it takes about 19.8 seconds to perform the task. Now type in Listing 2. Most of this program reads in the machine-code program in DATA statements, and places it into memory. The machine-code itself fills the screen with yellow 'A's, just as in Listing 1. Try timing it. Whoops.... there wasn't even time to start and stop your stopwatch! In fact this machine-code program completes its work in the region of one-hundredth of a second — an increase over Basic of nearly 2000 times!

Machine Code Fundamentals

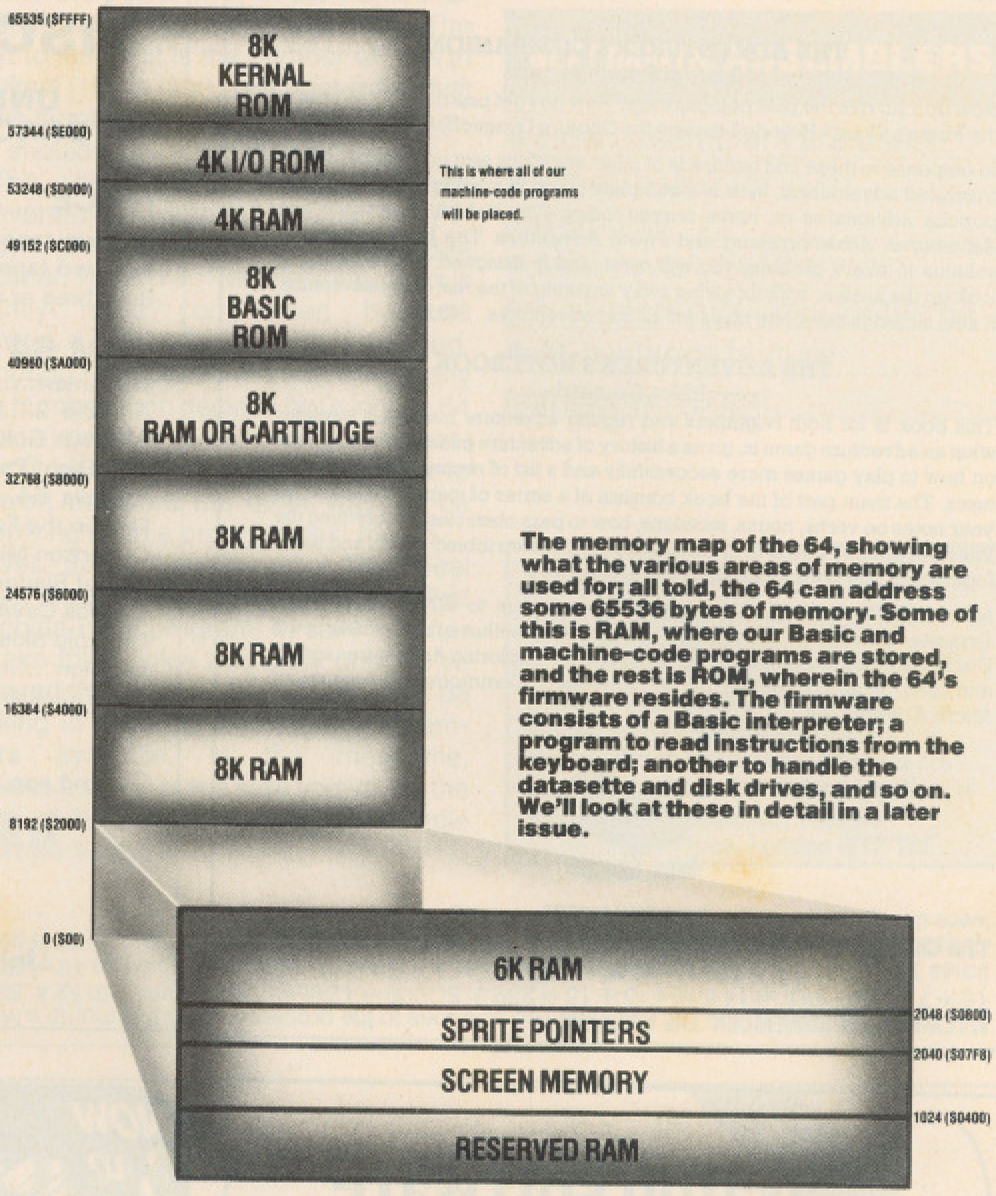
The first thing we have to look at is how the 64 handles numbers. In machine-code, there are three types of numbers: instructions, variables, and constants. Instructions are similar to those you'll find in Basic (for example, PRINT — see earlier), and variables, too, are much the same — except that labels (e.g. SC$) are replaced by memory locations in the 64's RAM (e.g. 11000). Constants are prefixed with a # to distinguish them from memory locations. For example, #200 is the constant 200, while 200 is the memory location 200. You'll be surprised to begin with how many times you miss out the #; don't worry, it's just a matter of practice.

During the early Seventies, Britain changed from 'old' to decimal currency. What the government was asking people to do was to learn a new base — decimal (base 10); up to then they'd been used to dealing with 12 old pennies to the shilling (base 12). Now, most assemblers work in hexadecimal (base 16) notation — known as hex for short. Some, however, let us use two bases — decimal and hexadecimal. Learning hex isn't difficult, just a little unnatural to us basicites!

Now would be a good time to get used to the standard notation of preceding hex numbers with a $. Let's look at a one-digit number first. In hexadecimal, a one-digit number can take a value between 0 and 15. So how do we represent 15 as a one-digit number? In hex we use the letters A to F to represent 10 through to 15 decimal. Therefore $A is 10, $C is 12, and $F is 15.

In decimal we 'roll-over' to the next digit when we reach 10. In other words, 9 'rolls-over' to 10. In hex, numbers 'roll-over' when they reach 16, so that $F (15 in deci-

COMMODORE 64 MEMORY MAP



The memory map of the 64, showing what the various areas of memory are used for; all told, the 64 can address some 65536 bytes of memory. Some of this is RAM, where our Basic and machine-code programs are stored, and the rest is ROM, wherein the 64's firmware resides. The firmware consists of a Basic interpreter; a program to read instructions from the keyboard; another to handle the datasette and disk drives, and so on. We'll look at these in detail in a later issue.

Listing 1

```
5 REM PROGRAM 1
10 PRINT"♥"
20 PRINT"START"
30 FOR I = 0 TO 999
40 POKE 1024+I, 1 :REM 1 IS 'A'
50 POKE 55296+I,7 :REM 7 IS YELLOW
60 NEXT
70 PRINT "FINISH"
80 END
```

Listing 2

```
5 REM PROGRAM 2
10 PRINT"♥"
20 FORI=0TO33
30 READA
40 POKE828+I,A
50 T=T+A
60 NEXT
70 IF T <> 3287 THEN PRINT"ERROR IN DATA STATEMENTS":STOP
80 PRINT"PRESS ANY KEY"
90 GET A$:IFA$=""THEN90
100 PRINT"♥"
110 PRINT"START"
120 SYS828
130 PRINT"FINISH"
140 END
1000 DATA 160,0,169,1,153,0,4,153,0,5,153,0,6,153,0,7,169,
     7,153,0,216
1010 DATA 153,0,217,153,0,218,153,0,219,136,208,225,96
```

The two programs to fill the screen with yellow A's — the first in Basic, the second in machine-code.

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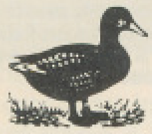
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Mike and Peter Gerrard are regular contributors to *Which Micro?* and *Personal Computer News*. Peter Gerrard is the author of many titles in the Duckworth Home Computing list, including the Exploring Adventures series, and contributes to *Popular Computing Weekly, Commodore Horizons* and *Micro Adventurer*.



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Y64

THE COMPLETE Y64

MACHINE CODE TUTOR

mal) becomes $10, $1F becomes $20, $2F becomes $30, and so on. Two-digit numbers in hex can therefore hold any value up to $FF (255 demical).

The locations in the 64's memory can only hold two-digit numbers and if we keep adding one to them, $FF automatically 'rolls-over' to become $0 (something which we will find very useful later). $FF is 255 decimal, so each location can hold any one of 256 numbers (including zero). The 64 can address up to 65535 ($FFFF) bytes — a four-digit hex number.

Decimal/Hex Conversion

It's clearly vital to have some easy way of converting hex to decimal, and decimal to hex. So, how is it done? Well, in decimal the number 1706 is one thousand, seven hundred, no tens, and six units. In other words, in this particular system, each column has a specified value. The one, for example, is in the thousands column and a thousand is ten cubed (ten to the power three). In hex, the left-most column of a four-digit number is 16 cubed (or 16 to the power three) — which is 4096. The next digit is the number of hundreds in decimal (ten to the power two) or the number of 256s in hex (16 to the power two). The next to last digit is the number of tens in decimal (16s in hex). The right-most digit is the number of units, or ones. An example should help make all this clear.

The hex number $1706 when converted to decimal is (1 × 4096) + (7 × 256) + (0 × 16) + (6 × 1) — that is, 5894 decimal. To convert from decimal to hex is slightly more complicated because several calculations are needed. Although I suggest that you convert any hex numbers into decimal by using the 64 as an expensive calculator, you'd be better off using a small Basic program to convert numbers the other way. I'll be supplying such a program next month.

Well, that's it for this time. Don't feel upset that we've yet to write our first machine-code program; it really is better to take things nice and easy until we've covered the basics. Next month, we'll be looking in detail at the different assemblers available. In the meantime, however, just to make sure you've got the hang of hex, try completing the simple exercise below.

Homework

Nothing too hard this month. Your task is simply to convert the following hexadecimal numbers to decimal:

1. $17, 2. $EF, 3. $C000, 4. $2710, 5. $A8F0

NEXT MONTH: ASSEMBLERS

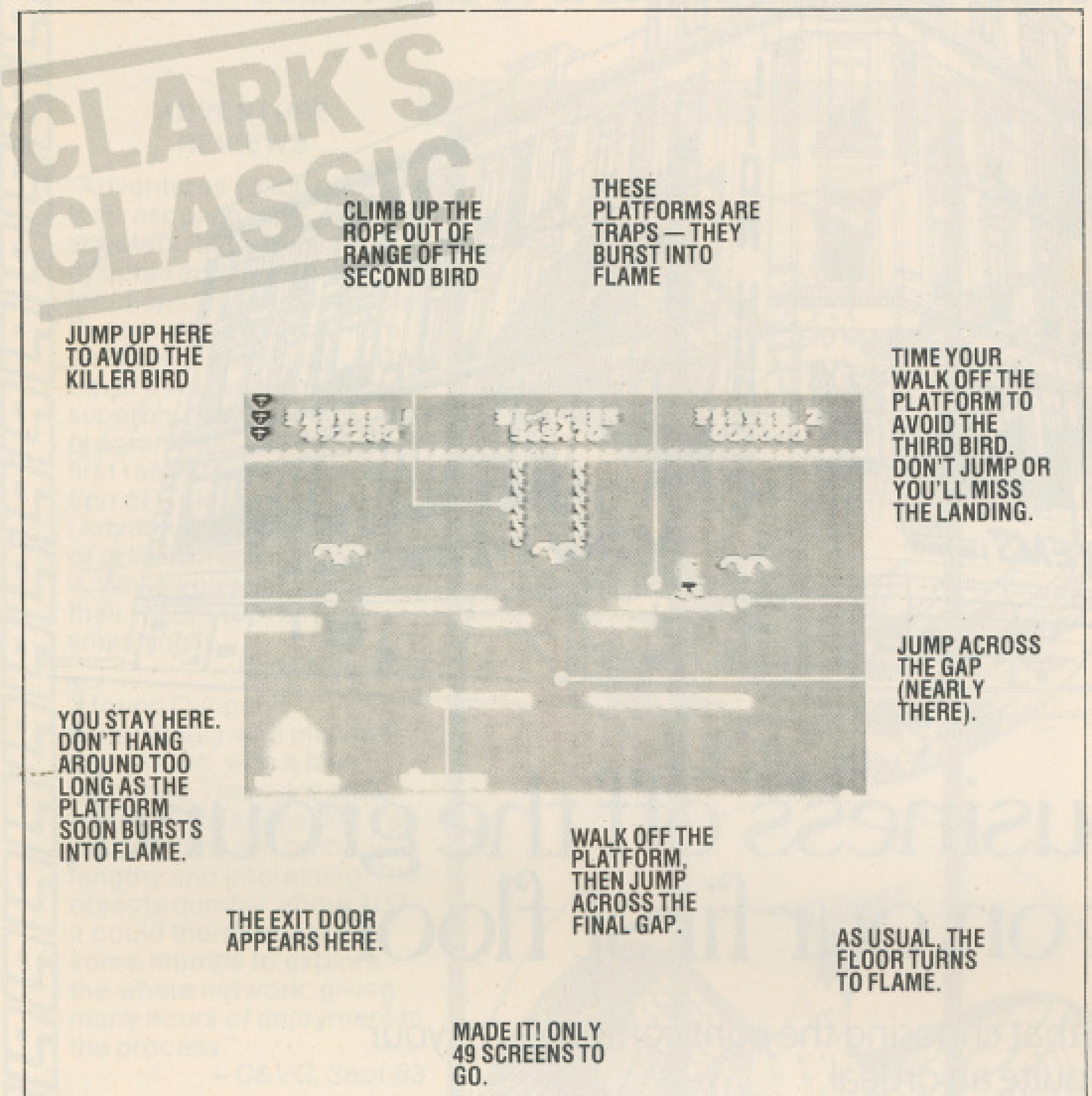
- How assemblers are used
- What to look for in an assembler
- Mini-reviews of the main assemblers available for the 64
- At-a-glance feature comparison chart

Interaction

Over the next four or five issues, Y64 will be happy to receive questions relating directly to this machine-code tutor — the most interesting of which are likely to be answered via a special appendix to the series. Please restrict your points to the level reached thus far, addressing them to Machine-Code Queries, Your 64, 14 Rathbone Place, London W1P 1DE.

MACHINE CODE HOMEWORK: THE ANSWERS The solutions to the problems set in this month's Machine Code Tutor are as follows: 1. $17 = 1 times 16 + 7 = 23 2. $EF = 14 times 16 + 15 = 239 3. $C000 = 12 times 16 cubed = 49152 4. $2710 = 2 times 16 cubed + 7 times 16 squared + 1 times 16 = 10000 5. $A8F0 = 10 times 16 cubed + 8 times 16 squared + 15 times 16 = 43248 If you got only three (or less) of the above questions right, then I suggest you go back and read the hex parts again. If you got all of them right — but didn't really understand what you were doing — don't worry, you'll pick it up as we go along.


fantasy
SOFTWARE
"Ziggy turned, his fingers clutching the trigger of his capsule gun, something had startled him or had it?
He looked back, he had grown very tired from his many exploits in THE PYRAMID negotiating 120 different chambers and coming face to face with some pretty nasty aliens.
No sooner than he had accomplished this mission, he was summoned by Time Lord Hamilton (known as Super Ham to his friends) to go to DOOMSDAY CASTLE and to save the Universe from the infinitely evil Scarthax, this being no small task took several megayears. By this time Ziggy was completely exhausted, his capsule battered, dented and wobbling as he limps in the direction of home, a real super hero of our time. Unable to leave the Universe undefended he radioed his great friend and colleague Beaky on the planet of Crackit to stand guard until his return.
Beaky would normally assume this role without a second thought, however he had his own problems to face for the dreaded Eggsnatchers had returned to threaten the very existence of his breed. Beaky's survival instincts do not allow him to leave Crackit until he has reared enough chicks to fight off the Eggsnatchers. In order to crack it, he must pass through 12 different stages each getting progressively harder.
So we have it, Ziggy returning home for a complete refit under the illusion that Beaky is defending the Universe, surely it can't take Beaky that long to secure his own species and when will Ziggy be back.....?"
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HERCULES

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Hercules is a *Manic Miner*-style platform which builds the original idea into spectacular entertainment.

The game simulates the 12 labours of Hercules, and completing all 50 screens certainly takes a Herculean effort. To finish the course, a player must successfully accomplish the first 11 labours before proceeding to the twelfth and final one. The first 11 are presented in random order — a now common technique that helps stave off the boredom caused by a total inability to progress beyond the first screen. However, once you have managed to complete the first screen of a labour, you are immediately plunged into the second; each consists of between three and seven screens.

The illustration here depicts some of the perils that await you; there'll be such common-a-day problems as platforms that suddenly turn to flame, and also killer birds. You'll have, too, to get pretty nifty at jumping between platforms and you'll need a keen sense of timing to avoid dangers, and quick reactions to stop yourself being roasted. Other screens require a cool nerve; often the best move is to walk or leap into oblivion, only to land safely on a platform that you were never really sure was there to begin with!

Verdict: Hercules is obviously modelled on the Manic Miner-type game, but it's extremely well presented. If you want to know what's involved in the 12th labour, come back in six months or so **(90%).**

BEACHHEAD

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Arm yourself with a cool nerve and steady joystick action and you're ready to tackle the six stages that make up this splendiferous wargame. The aim? To try and establish a beachhead on enemy soil.

Two of these stages are shown in the screen shots, the first being an attack by enemy planes. However, before you even reach that point you must first steer your fleet through a secret passage full of mines and torpedoes in an attempt to surprise the enemy and catch him unawares in the harbour. That's when the enemy planes attack! Your job is simple . . . shoot them down as they scream overhead and stop them from destroying your ships.

Once you've fought off the enemy aircraft, their ships open fire. Now's the time to man the guns and destroy them before they get you. As the last of the enemy fleet sinks in the west you are ready to enter the next stage — the beachhead itself.



Every ship that's survived the previous onslaught lands two tanks and these make their way up the beach, avoiding mines, enemy tanks and gun positions. Any that survive enter the final battle and attempt to destroy the fortress of Kuhn-Lin. To raze the fortress you must hit twelve targets — before being inevitably destroyed by a giant gun turret.

The game features superb sound effects, which don't come across too well in a review but I think you'll get the picture when I say that they make the graphics appear puny.

Verdict: Superb action game — one of my favourites. **(85%)**

LOCO

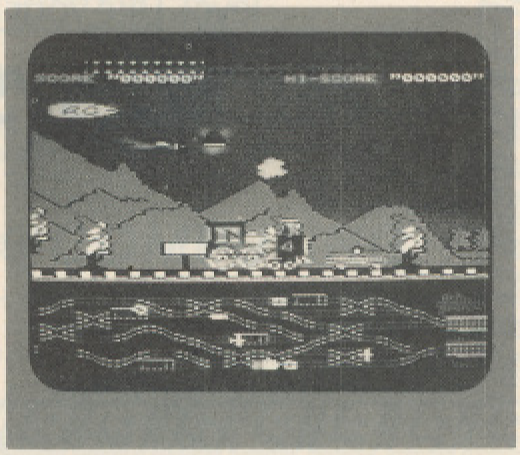
Alligata Software £7.95

The next time you're late home because the 6.34 from Paddington didn't bother to turn up, spare a thought for the poor train driver. After you've played this game, you might just have some idea of the problems he's had to face.

It all starts quite serenely as you pull your steam engine out of the station and head off down the track. Suddenly the peace is broken by the arrival of a bomber-plane, piloted presumably by some dissatisfied BR passenger. A quick blast of steam will bring it down, but that's only the start of your problems as you come under attack from a series of aircraft, bomb-dropping airships and exploding handcarts on the track ahead.

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"I found Dungeon exceedingly well planned and written, with a fast response. There are well over 200 locations and the descriptions are both lengthy and interesting. The objects number about 100. It could therefore take some months to explore the whole network, giving many hours of enjoyment in the process."

– C&VG, Sept 83

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–Which Micro?, Aug 83

"My appetite has been whetted and I intend to get my own copy (of Snowball) to play."

– What Micro?, Dec 83



ADVENTURE REVIEWS

"This has to be the bargain of the year. If adventures are your game then this (Colossal Adventure) is your adventure."

– HCW, 5 Sept 83

"Colossal Adventure is simply superb. Anyone who wishes to use adventures in an educational setting really must use and see this program as it emulates Crowther and Wood's masterpiece so well. For those who wish to move onto another adventure of similar high quality, Dungeon Adventure is to be recommended. With more than 200 locations, 700 messages and 100 objects it will tease and delight!"

– Educational Computing, Nov 83

Colossal Adventure is included in Practical Computing's Top 10 games choice: "Poetic, moving and tough as hell."

– PC, Dec 83

"To sum up, Adventure Quest is a wonderful program, fast, exciting and challenging. If you like adventures then this one is for you"

– NILUG # 1.3

"Colossal Adventure . . For once here's a program that lives up to its name . . a masterful feat. Thoroughly recommended"

– Computer Choice, Dec 83

"wholly admirable"

– Your Computer, Sept 83

MIDDLE EARTH ADVENTURES

1: COLOSSAL ADVENTURE
A complete, full size version of the classic mainframe game "Adventure" with 70 bonus locations added.

2: ADVENTURE QUEST
Centuries have passed since the time of Colossal Adventure and evil armies have invaded The Land. The way is long and dangerous; but with cunning you can overcome all obstacles on the way to the Black Tower, source of their demonic power, and destroy it.

3: DUNGEON ADVENTURE
The trilogy is completed by this superb adventure, set in the Dungeons beneath the shattered Black Tower. A sense of humour is essential!

THE FIRST SILICON DREAM ADVENTURE

1: SNOWBALL
The first of Pete Austin's second trilogy. The giant colony starship, Snowball 9, has been sabotaged and is heading for the sun in this massive game with 7000 locations.

THE LORDS OF TIME SAGA

7: LORDS OF TIME
Our congratulations to Sue Gazzard for her super design for this new time travel adventure through the ages of world history. Chill to the Ice-age, go romin' with Caeser's legions, shed light on the Dark Ages etc. etc. We'll be selling this game mail-order from January 1st.

Price: £9.90 each (inclusive)

Level 9 adventures are available from good computer shops, or mail-order from us at no extra charge. Please send order, or SAE for catalogue, to:

LEVEL 9 COMPUTING

Dept Y64 229 Hughenden Road, High Wycombe, Bucks HP13 5PG

Please describe your Computer

train through the five stations and on to the next level, the perils of which I cannot tell as I've never managed to get that far. Mebbe I'm being distracted by that annoyingly addictive tune. Mebbe I'll do better in the next game . . . hum, hum, hum.
Verdict: A fun arcade game with superb sound and graphics. **(75%)**

STALAG 1

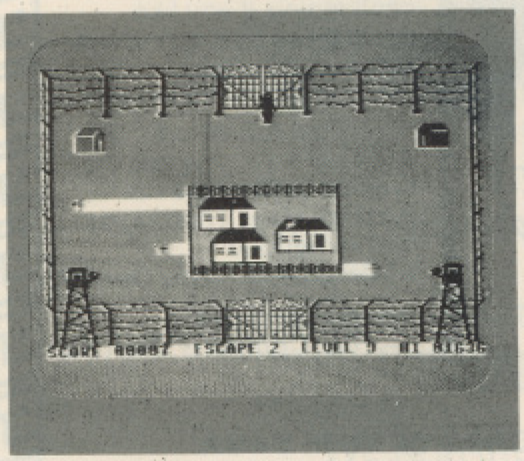
Rabbit Software £5.99
Stop the prisoners from escaping the central encampment!

"Zere vill be no escapes von Stalag 1 vhile I am ze kommandant." That is your claim, and your aim too in this totally wacky (not to say, tasteless) game.

The prisoners are held in a central enclosure, around which you patrol. Suddenly you hear a noise as someone attempts to tunnel out under the perimeter fence. Immediately you rush over and thwart the attempt. But then another tunnel starts, and another, and another . . . all in different directions. How are you going to cope?

Once you've foiled several escape attempts, you progress onto the next level where the prisoners tunnel faster and more frequently. Initially the change is gradual, but within a short time the escapees are swarming out. Once a tunnel is completed, other prisoners will use it too — until you close it. If there are six escapes, your superiors replace you.

Perhaps all this sounds a bit too easy. Well, in that case you'll no doubt be looking forward to the later levels where the prisoners are aided by savage dogs; one



bite from these brutes will paralyse you for a few vital seconds.
Verdict: Tasteless escapism, with a certain 'je ne sais quoi' **(65%)**

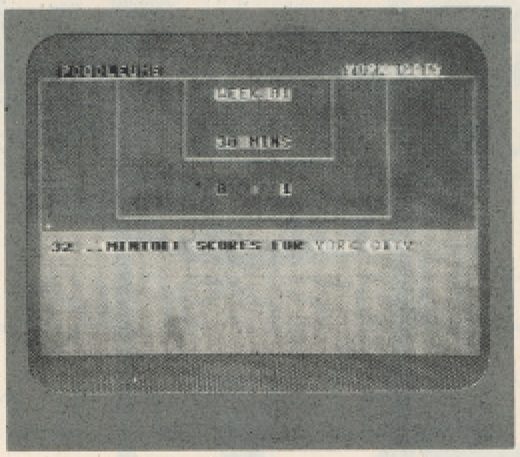
THE BOSS

Peaksoft £8.95
If you've ever thought that you could do better than Bobby Robson or Brian Clough — well, now's your chance to prove it. Buy yourself a large silly hat and a big cigar, and settle down to manage your favourite team.

Starting in Divison 2, 3 or 4, you have to guide your team to fame and fortune. Along the way you'll have to cope with injuries and suspensions, as well as the intricacies of club finances. For the lower divisions, promotion is the prize — and possibly even a chance of European glory.

The game is text-only and, strangely, there are only four other teams in your division and you have to play each of them four times. This means that you'll be without a fixture for four weeks of the season. Unfortunately, the players still expect to be paid during this time, so you could run into money problems. This can be serious, since the game will not allow you to continue if you're in debt; you have to raise the spondulicks in some way or other. You can borrow money from the bank, but there's a limit to the generosity and understanding of even the friendliest of bank managers; then again, you could sell your star striker — or perhaps several of your lesser-known players. Either way, it's your problem because, as the game says, you're the boss.

Enjoyment of the game isn't badly affected by the lack of teams, nor the



dearth of graphics — you are kept up-to-date with minute by minute reports during the games. Perhaps it really does simulate the vantage-point of the typical manager . . . propped up against the bar.
Verdict: Could have been done better, but still worth the effort **(70%)**

FALL OF ROME

Argus Press £6.99
The Huns are coming! The Vandals are coming! So are the Persians, Arabians, Visigohs, Picts, Scots and Armenians. There's no taking to the hills either because you're the Roman Emperor and it's your job to stop them. So, mobilise your legions and forward into battle!

And so starts an enjoyable wargame in which you must organise your troops and resources in an attempt to stop the invading hordes. The resources in question are the riches that each province can produce in each of the twelve turns. With this money you can raise legions, cavalry and auxiliaries. This is fine for the richer provinces, but part of your empire may lack the funds at a crucial moment. You take care of this by moving money around the Empire, being sure not to plough funds into a province that you are about to lose.

The screen displays are adequate, consisting mainly of blobs on a map, but I found both graphics and sound disappointing — considering the 64's facilities. The game has been released for several machines and it seems that the effects reflect the lowest common denominator — bad luck for owners of the more expensive micros.



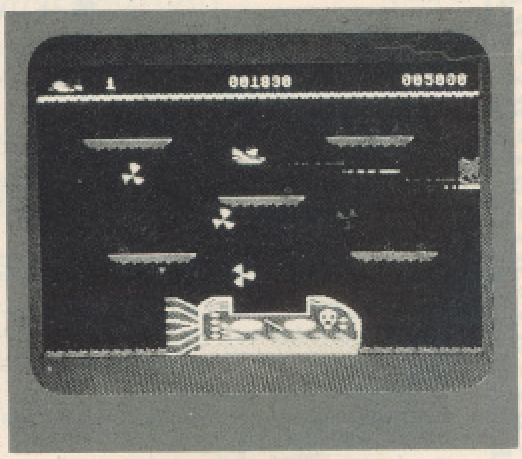
Your performance is judged at the end of the game, with an appropriate rating awarded — ranging from strategic victory, through historical result, down to the far more likely strategic defeat.
Verdict: It's historic fun bashing vandals — shame about the effects. **(70%)**

CUTHBERT IN SPACE

Microdeal £8 (Cassette), £9.95 (disk)
Once upon a time there was a game for the ZX Spectrum called *Jetpac*. Okay, maybe *Cuthbert* isn't a straight copy, but it sure looks very familiar.

Let's examine the screen shots and see if we can spot the difference. In *Jetpac* you have to fly among the platforms, avoiding swarms of aliens and collecting parts of a rocket before you can escape. Our young Cuthbert already has a spacecraft and he has to fly around the platforms, avoiding the swarms of aliens and collecting fuel before he can escape.

Once Cuthbert is ready to go, he returns to his ship and takes off. But (surprise, surprise) there's a bomb on board and that means a quick dash across to a nearby mothership before the bomb explodes. Once successfully defused, it's back to collecting fuel . . . then yet another bomb



. . . and another . . . and on . . . and on.

Microdeal has previously only ever sold software for the Dragon, so the two games have never been direct competitors; probably they're sufficiently different not to attract legal problems, anyway. On the other hand, if you're looking for an original game . . . thjs isn't it.
Verdict: Another zap-em-up spacegame that's best left in space **(55%)**

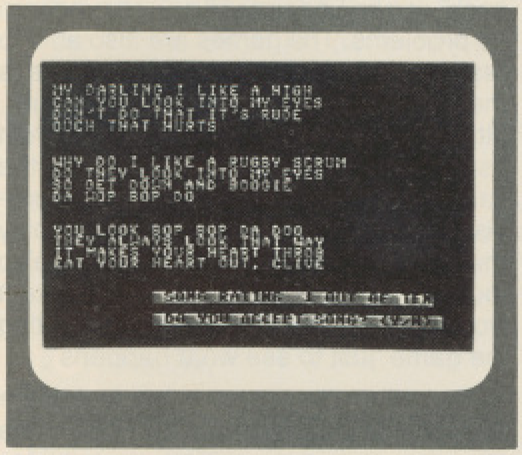
IT'S ONLY ROCK AND ROLL

Ktel £6.95
Will you conquer Europe and the States

with your singing talent? Or will you be relegated to obscurity and occasional appearances on the Val Doonican show? All will be revealed as you try climbing the slippery ladder of showbiz stardom.

Realistically, all is stacked against you as the game begins. You're penniless, unknown and wary of the corrupt managers who await your business. What it boils down to is that, each month, you have to make key career decisions from menus of options. Initially, your choice is limited to busking or risking a manager; later on there'll be concerts at Wembley and maybe even a foreign tour or three.

To win the game, you have to accumulate £1 million and three status symbols before you grow too old or get so depressed that you leave the business. Your age is obviously controlled by the



number of turns that you've used, while your happiness is seriously affected by events. If your concert is raided by police, for example, this adds to your depression factor.

Other random events include offers of recording contracts and boosts in popularity on the plus side — and drug probes and cancelled contracts on the other. The ultimate devastation is the announcement that Tony Blackburn likes you — which naturally spells doom to your career.

The game is well supported by sound and graphics and you can even watch yourself as you perform.

Verdict: Obviously the work of a pop cynic, but compelling **(65%)**

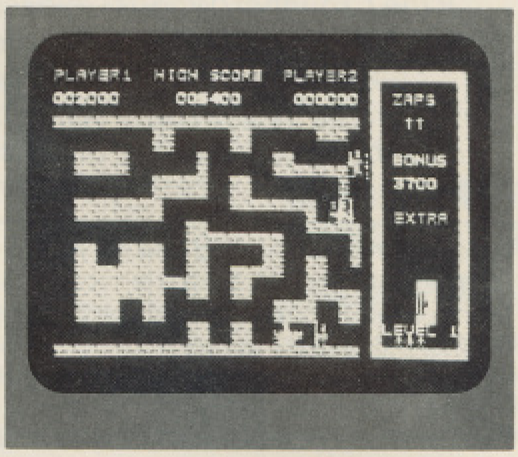
CAVELON

Ocean £6.90

Cavelon scores over other maze games, mainly because there actually seems to be some point to the exercise. A princess has been captured by the black wizard and is being held at the top of his castle; your task (as if you didn't know) is to rescue the good lady . . . unoriginal, perhaps, but better than nothing.

First some useful on-screen instructions, then the quest begins. One of those instruction screens is shown below; note the *black wizard* . . . he's the one cunningly dressed in white. Not only is the wizard clever enough to disguise himself, he attempts to block your progress by the most dastardly of methods. He's obviously heard that you've been told to progress through the six levels, passing through the doors on each to progress on to the next. To foil your attempts, oh clever one with the pointed hat has taken down all the doors, broken them up and dispersed them throughout the mazes. Damned cunning, these wizards.

So, what you have to do is toddle around the maze, collecting up all of the bits and reassembling the door — so you can open it to start the whole process again on the next



level. Who said games writers are running out of fresh ideas?

Just to add to your problems, the wizard has employed some knights and archers to bother you, but I wouldn't worry too much about them — they'll be too busy laughing at your hopeless efforts to be much of a problem.

Despite the frustrations, the game really is fun. The only thing is, the next time someone asks you why you play computer games, remember not to claim that they're intellectually stimulating.

Verdict: A degree of novelty, and challenging enough to hold interest **(75%)**

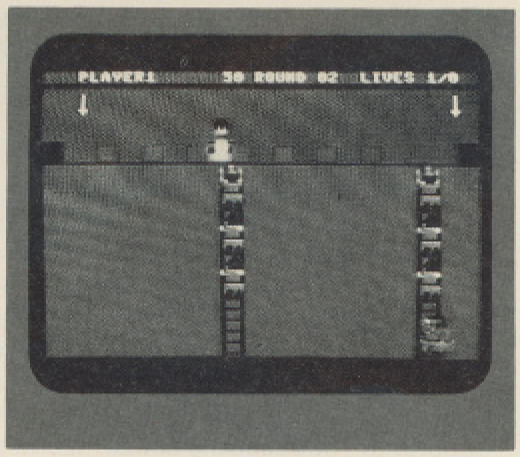
ORC ATTACK

Creative Sparks £8.95

Having admired the artwork on the cover, and read the graphic description of the horrors that awaited me, I eagerly loaded the program to find . . . a load of green blobs with big noses!

The green things with the noses are supposed to be the evil-spawned creatures that terrorised Bilbo in *Lord of the Rings*. These don't look as though they could terrorise a slug, as they waddle along the bottom of the screen and amble up ladders in an attempt to take your castles.

Once they reach the top of the ladders they are supposed to ferociously attack



you. Instead, they sit there frantically waving their arms around. Perhaps they're working up to a really big sneeze to blow your head off.

But don't feel too sorry for these snivelling wrecks. Having failed in their attack, they fire crossbow bolts at you — which is more plain anti-social than dangerous as it's a simple job to put them out of their misery.

Up to four people at a time can be bored stupid by this nonsense. If you want to make it more challenging, I suggest you try playing it blindfolded.

Verdict: Sorry — big let down of the month; good cure for insomaniacs **(40%)**

BEST OF THE REST

It's obviously impossible to include a review of every game that appears each month on the market. Here therefore is a brief round-up of some of the offerings we've received but which we haven't been able to review fully.

If you like your action in 3D, try **Encounter** from Novagen (£8.95).

It's a scaled-down version of the arcade classic **Battlezone** — scaled-down because at any one time there's only ever one object to shoot at. Even so, it travels at an alarming rate and the action is fast and furious.

Further 3D delights are available from Livewire, in the form of three games. **Triad** (£8.95) is a 'zap-em' space game, **Grid Trap** (£8.95) is a good version of the 'defuse-the-bomb' type game, and finally there's an excellent 3D frogger called **Jumping Jack** (£8.95).

A nice variation on the frogger theme is **Turtle Jump** by Romik (£6.99). This revolves around the antics of Ekim, a giant ant that has to hop (?) across turtles' backs in an attempt to reach some treasure.

Treasure-hunting is also the theme of Rabbit's **Galleons** (£5.99), a pirate game for up to four players. The action features quite realistic sailing techniques, which no doubt explains why I got absolutely nowhere with it.

Back on dry land, Commodore has released two new disk-management games: **Rail Boss** (£11.95) a Wild West railroad epic, and **High Flyer** (£11.95) in which you play a post-war airline operator.

As I point out in the **Cuthbert in Space** review this month, there's a flurry at present to adapt existing games to run on the 64. Conversions so far include Melbourne House's **Horace** series and a number of New Generation games — including **Trashman** (£5.95) — to be marketed by Quicksilva.

Somebody who is rapidly adapting games to the 64 is that micro maniac supremo, Jeff Minter. All Minter minions should note that Minter madness continues unabated with the release of his latest offering, **Sheep in Space** (£7.95) — which makes a change from camels, I suppose.

Micro Power, a company well-known to BBC users, has some new releases, including a sub-standard mini **Manic Miner** game called **Ghouls and Swoop** (£6.95); galaxians plus under-nourished aliens is the best description I can think of.

Finally, for those with an ecological bent, why not try Starcade's **Savage Pond** (£8.95). This supposedly chronicles the sad life of a poor tadpole, struggling for survival against natural and man-made hazards. What do you mean . . . shoot it?

ZORK TALK

If the Crowther/Woods Colossal Cave *adventure (reviewed in its Level 9 version in Issue 1) is the ancestor of the computer adventure game, then* Zork, *likewise originally created on a DEC mainframe system (and still to be found on many large computers) must be counted as* the *great adventure. It's a traditional text-only game, a system which to my mind gives the best graphics possible!*

The *Zork* trilogy is unfortunately only available on disk, and it's almost certain to stay that way — I can't see any form of data compression being good enough to cram the whole thing into main memory and yet retain the full richness of description and response available from this classic. Good news for disk users, though, is that the series has recently been made available direct from Commodore. At a price of £9.99 for each part, it's a considerable saving over the old rate — and very reasonable for any disk-based adventure.

From your starting point outside the White House (no, not *that* one!) you enter the Great Underground Empire, where, in *Zork 1*, your task is to regain the 20 Lost Treasures of Zork. Quite how the treasure was lost is never explained, but after playing for a while and becoming acquainted with some of the inhabitants of the Empire, I think it's probably better not to ask!

As you toil to fulfil your task, you will meet with a number of adversaries — a testy Troll, a audacious Thief, and a hungry Cyclops amongst others; you'll explore too a realm full of treasure and enchanted items. It's not all dungeons and dragons, though; you'll also find pieces of assorted high and low technology left by the previous inhabitants of the Realm. There's a marvellous piece of machinery in the control room of Flood Control Dam 3, for example: inexperienced fiddling with this can lead to the most distressing results! Puzzles and problems abound, not least how to regain the surface after the trapdoor has been bolted behind you.

There are only two mazes, but these can be a little difficult to map; the usual trick of dropping assorted plunder in the rooms is thwarted by the Thief, whose voice you hear from afar as he takes your markers and adds them to his store of booty. Your journey will also lead you through many other perils and dangers, from the sheer exhilaration of crossing the rainbow, to plumbing the depths of Hades itself.

Your mission accomplished, you are led from the house to an ancient stone Barrow: enter, and as the door slams shut behind you and the final sentences scroll up the screen, you realise that you have only achieved the first part of a three-part adventure! As you are now totally hooked, you rush out to your local dealer and beg, steal, borrow (perhaps even buy) *Zork II*.

Ever Onwards

Awakening in the Barrow (a couple of familiar items — including your trusty lamp — having found their way in with you), you discover that the exit, previously blocked, has opened up in front of you. Your next task is to wrest control of the Empire from the increasingly senile Wizard of Frobozz. Senile he may be, but he's far from powerless as he impedes your success by the casting of nasty spells upon you.

Here again, the magical rubs shoulders with the merely mechanical. Just how do you trap a unicorn (which has some very odd dietary habits)? And how do you discover what to do in a control room (that controls you know not what), with three unmarked buttons to push? Once again, you have the opportunity to fiddle with some decidedly unfriendly technology and ponder the occasional oddity — such as the glacier in the middle of a volcano! I will but offer one hint on *Zork II*. Remember that it was produced in America, and be prepared for some late night head-scratching if you want to finish it — to become a Superior Adventurer with a full 400-point total.

As you complete this part, you're made aware of the third and final section. In this, you are again tested and, if found worthy, can become the dungeon-master himself — as well as taking a valuable controlling interest in the Frobozz Corporation! This one currently has me baffled. Amongst other things, the scoring system is completely different to the first two parts; I've scored six out of seven points, but don't know how or why... I guess that's adventure for you.

In common with all adventures, the *Zorks* need to be mapped carefully; but they are not large rooms in the physical sense — about 120 rooms in *Zork 1*, 80 in *Zork II* and only about 60 in *Zork III*. These are games of subtleties, from working out just where the Great Underground Empire actually is, to trying to communicate with the other denizens of the dungeon. It's vitally important to read everything placed at your disposal with the utmost care. This includes not only the screen itself, but also the documents provided with the game — I managed to spend two weeks in one room in *Zork II*, all because I hadn't read the section on how to talk to the other inhabitants!

Secret Parser-Words

And talking of talking, the one thing that makes the *Zork* trilogy (and the rest of the Infocom series) stand out is its parser — the part of the controlling program that allows you to communicate with it. This was written by Mark Blanc, apparently in a high level language resembling Lisp. I say 'apparently', because the actual mechanics of the parser are a very closely guarded secret. Instead of the old one or two word style of talking to the program, used in the original adventure, the Infocom series allows you the sheer luxury of using whole sentences; so a command such as "kill the dwarf with the glowing sword then put its body into the sack" can be understood and obeyed with no problems. The games are also able to respond to questions such as "Where is the treasure", or "What is a Grue", although the answers are rarely of direct use, (but read them carefully all the same). Another very nice touch is the provision of 'extras' to the main plot; not only the infuriating red herring or six, but also touches of humour — enough to make it worthwhile going back after completing the game 'just to see what happens'.

The adventure is made easier by the provision of a save facility; just type in the word 'save', and you will be prompted to put a formatted disk in the drive and enter a number under which to save your position — eight separate saves can be retained, enabling you to take chances without having to risk losing all. Another feature is the provision of a 'script' command which, provided you have a printer connected to the computer, will enable you to make a permanent record of your travels. In order to help those who get utterly lost within the Great Underground Empire, Infocom has a set of maps available, and invisiclues to the puzzles in the adventures. The latter consist of questions, each with a number of possible answers — from a cryptic clue to outright solution. Each is covered and can only be revealed using a special pen. Details of how to obtain such things are included with the same package.

In all, the *Zork* trilogy is one of the most addictive adventures on the market today. In the United States there is a *Zork* Users Group, and the fascination which holds players can be seen very clearly by anyone using the main American databases, the Source and Compuserve; on those, whole areas are given over to discussion between players. The really great news for everyone who has battled his or her way to the end of *Zork III* is that another trilogy, based this time on the use of magic rather than the manipulation of objects, has been prepared by the same team responsible for *Zork*. The first two parts, *Enchanter* and *Sorceror*, are currently available, and reviews of both will appear here shortly.

Now, where did I leave that lamp....

Part of a sample 'conversation' with Zork

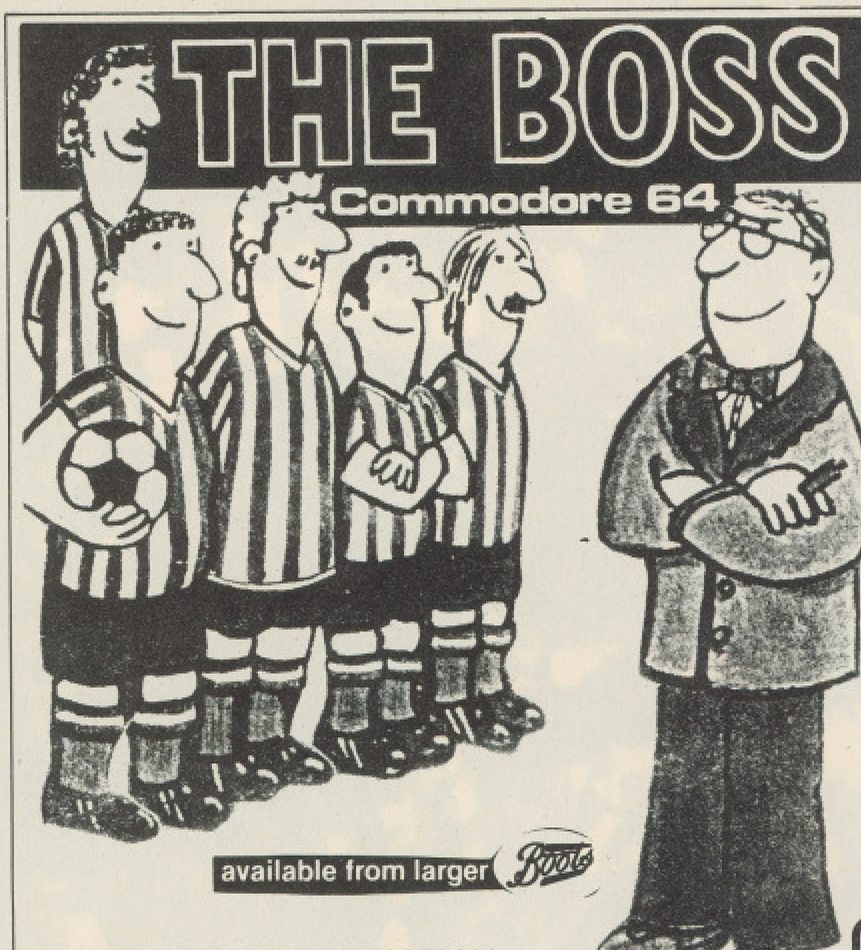
```
THE LAMP IS NOW ON.
ATTIC
THIS IS THE ATTIC. THE ONLY EXIT IS A
STAIRWAY LEADING DOWN.
ON A TABLE IS A NASTY-LOOKING KNIFE.
A LARGE COIL OF ROPE IS LYING IN THE
CORNER.
>GET ALL THEN GO WEST, OPEN THE TRAPDOOR, THEN GO DOWN
TABLE: YOU CAN'T BE SERIOUS.
NASTY KNIFE: TAKEN.
ROPE: TAKEN.
YOU CAN'T GO THAT WAY.
>GO DOWN THEN GO WEST, MOVE THE RUG, OPEN THE TRAPDOOR THEN GO DOWN
KITCHEN
ON THE TABLE IS AN ELONGATED BROWN SACK,
SMELLING OF HOT PEPPERS.
A BOTTLE IS SITTING ON THE TABLE.
THE GLASS BOTTLE CONTAINS:
  A QUANTITY OF WATER
LIVING ROOM
WITH A GREAT EFFORT, THE RUG IS MOVED TO
ONE SIDE OF THE ROOM. WITH THE RUG
MOVED, THE DUSTY COVER OF A CLOSED
TRAP-DOOR APPEARS.
THE DOOR RELUCTANTLY OPENS TO REVEAL A
RICKETY STAIRCASE DESCENDING INTO
DARKNESS.
THE TRAP DOOR CRASHES SHUT, AND YOU HEAR
SOMEONE BARRING IT.
CELLAR
YOU ARE IN A DARK AND DAMP CELLAR WITH A
NARROW PASSAGEWAY LEADING NORTH, AND A
CRAWLWAY TO THE SOUTH. ON THE WEST IS
THE BOTTOM OF A STEEP METAL RAMP WHICH
IS UNCLIMBABLE.
YOUR SWORD IS GLOWING WITH A FAINT BLUE
GLOW.
>N
THE TROLL ROOM
THIS IS A SMALL ROOM WITH PASSAGES TO
THE EAST AND SOUTH AND A FORBIDDING HOLE
LEADING WEST. BLOODSTAINS AND DEEP
SCRATCHES (PERHAPS MADE BY AN AXE) MAR
THE WALLS.
A NASTY-LOOKING TROLL, BRANDISHING A
BLOODY AXE, BLOCKS ALL PASSAGES OUT OF
THE ROOM.
YOUR SWORD HAS BEGUN TO GLOW VERY
BRIGHTLY.
THE FLAT OF THE TROLL'S AXE SKINS ACROSS
YOUR FOREARM.
>SWING SWORD
(AT THE TROLL)
A GOOD STROKE, BUT IT'S TOO SLOW, THE
TROLL DODGES.
THE AXE KNOCKS YOUR NASTY KNIFE OUT OF
YOUR HAND. IT FALLS TO THE FLOOR.
FORTUNATELY, YOU STILL HAVE A SWORD.
>AGAIN
THE FATAL BLOW STRIKES THE TROLL SQUARE
IN THE HEART:  HE DIES.
ALMOST AS SOON AS THE TROLL BREATHES HIS
LAST BREATH, A CLOUD OF SINISTER BLACK
FOG ENVELOPS HIM, AND WHEN THE FOG
LIFTS, THE CARCASS HAS DISAPPEARED.
YOUR SWORD IS NO LONGER GLOWING.
>GET ALL THEN GO EAST
BLOODY AXE: TAKEN.
NASTY KNIFE: TAKEN.
EAST-WEST PASSAGE
THIS IS A NARROW EAST-WEST PASSAGEWAY.
THERE IS A NARROW STAIRWAY LEADING DOWN
AT THE NORTH END OF THE ROOM.
>GO EAST THEN SE THEN EAST
ROUND ROOM
THIS IS A CIRCULAR STONE ROOM WITH
PASSAGES IN ALL DIRECTIONS. SEVERAL OF
THEM HAVE UNFORTUNATELY BEEN BLOCKED BY
CAVE-INS.
ENGRAVINGS CAVE
YOU HAVE ENTERED A LOW CAVE WITH
PASSAGES LEADING NORTHWEST AND EAST.
THERE ARE OLD ENGRAVINGS ON THE WALLS
HERE.
DOME ROOM
```

>GO DOWN THEN **GO WEST**, **MOVE** THE **RUG**, **OPEN** THE **TRAPDOOR** THEN **GO DOWN**

Unlike most simple adventure programs, which understand only a verb followed by a noun, Zork contains a sophisticated parsing routine works is a closely-guarded secret, but the routine allowing quite complex commands.

In the example given above, the user is issuing five consecutive commands in a single input. The way in which the parsing routine works is a closely-guarded secret, but the principle is straightforward. Firstly, all superfluous words (like THE) are removed. Secondly, the string is broken down into individual commands — in the example above, the word THEN and commas mark the boundary between different commands. Finally, each command is dealt with in turn.


RACE
MOVI SOFT 2



PHONE YOUR ACCESS NO.
FOR 24 HOUR DESPATCH

"The best game I have yet seen for the CBM 64" - J. Darling, Essex. **"I've been playing non-stop since it arrived"** - D. Nixon, London. **"Brilliant!"** - P. Fletcher, Nottingham. **"Excellent!"** - M. Thornton, Essex. **"There's not a lot it misses out on"** - A. Rochester, Cheshire. **"It's already given me many hours of enjoyment"** - P. Dennis, Tyne & Wear. **"I've been playing it almost incessantly"** - J. Meadows, Stretford. **"It's tough, addictive and great fun"** - P. Scrimshaw, Essex. **"Excellent - my son can't stop playing it"** - M. Sherratt, London. **"Last night, my wife and I were playing until 2am"** - G. Stirland, Aberdeen. **"The best in our collection"** - D. Allen, Belfast. **"It's really enthralling"** - R. Kamianko, Notts. **"A smashing and thrilling game"** - V. Parkin, Chelmsford. **"I've been playing non-stop for 8 hours!"** - D. Dennis, Derbys.

We believe we've created the most complete, compulsive and entertaining football management game ever. There are a total of 13 screens, to help you pick your team, make a swoop into the transfer market, spy on other clubs, talk to your (usually!) understanding bank manager, check on the season's fixtures and results, study the league table... and much more.

Your job is to build the best team possible with the cash and players available, face the day-to-day problems of running the club, then send the team out to do their best each Saturday. For successful clubs, there are big rewards - the league championship, the FA Cup, and a place in the European Cup or the Cup-Winners' Cup. But you'll also have to face struggles against relegation, or the heart-breaking decision to dismantle a big money side if a cash crisis threatens.

We hope The Boss will entertain you for years to come - we even provide a game save cassette, so that the career you begin today as a football club manager need never end.

You should find The Boss in all good software shops. But in case of difficulty, clip the coupon, and we'll send you a copy by 1st class post. It costs £8.95 and comes complete with a 7-page booklet and a written guarantee.

BRITAIN'S GREATEST FOOTBALL MANAGEMENT GAME

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COMMS LINK

Instant correspondence via electronic mail, swapping software by phone and multi-user adventure games are just a few of the glistering attractions offered by the world of communications. Throwing open the door to Communications Link, Surya *begins by sorting out the bits from the baud rates . . .*

Communications is flavour of the month in the micro world. You've only to open a magazine to see lists of bulletin-boards, advertisements for modems and so on. In future issues, *Your 64* will itself be reviewing modems and comms software. However, we're going to start by examining the way in which communications works.

Communications, comms for short, is a blanket term covering any form of information exchange between computers. Generally however, it's used to refer to the process of accessing a remote computer over the phone line using a micro.

Briefly, the aspiring hacker will need a micro with a serial port (both the 64 and VIC are suitable), some form of communications software, a modem and a telephone line — and that's about it. The communications software sends and receives data to and from the modem, the modem sends and receives data to and from the telephone and the phone passes data through the public telephone network (see Figure 1). A system like this allows you to logon to remote computers as if your computer was a directly-connected terminal. We'll look at a few examples later, but firstly for those in need, it's time now for the *Y64* comms primer.

Communications Breakdown

Let's start with modems (a shortening of MOdulator/DEModulator). 'O' level physics tells us that a modulator uses two waves — the first, known as the modulator or carrier, is constant, while the second, known as the modulated or carried wave, varies depending on the information it contains. Modulation is the process of converting an electrical signal into a modulated wave, and demodulation is the reverse.

There are two types of modem: acoustic and hard-wired. Acoustic modems (also known as acoustic-couplers) convert electrical signals from the computer into audio signals. The telephone handset plugs into a pair of rubber cups; audio sounds are broadcast into the mouthpiece and received from the earpiece. Acoustic modems are convenient, since you can use them on almost any telephone — including switchboard extensions — but are susceptible to interference from surrounding noise; they're not known for their outstanding reliability.

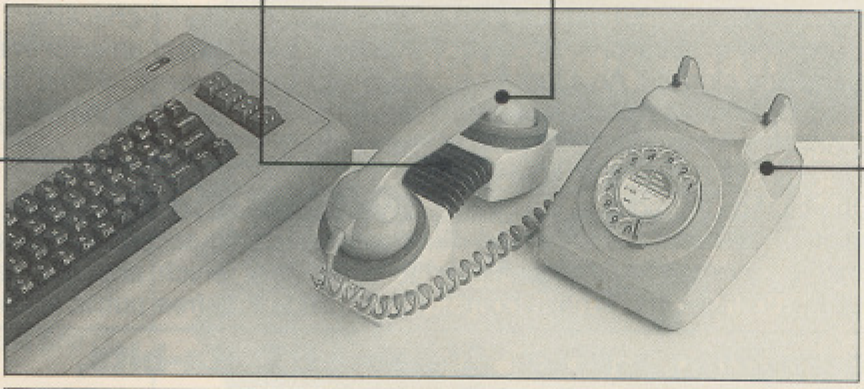
Hard-wired modems plug directly into the telephone socket and the telephone then plugs into the modem (see Figure 2). They require a standard BT telephone socket (fitted nowadays to around 25 million phones in the UK) but some older phones may have to be converted; BT will do the conversion free of charge.

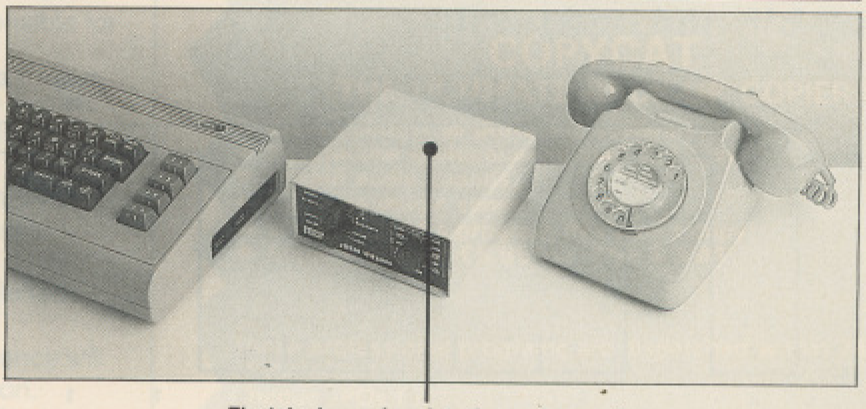
Because hard-wiring means connecting directly to the telephone network, the modems first require approval from that great god up the telephone pole, the British Approvals Board for Telecommunications (BABT). Modems are vetted firstly for safety (mainly to ensure there is no chance of mains voltages finding their way onto the telephone network), and secondly for efficiency (some modems can leave the line 'hung' at the end of a call).

Some hard-wired modems offer auto-dialling and/or auto-answering. An auto-dial modem can seize a number entered via the computer keyboard or — more usefully — look up a number in a database, and then dial that number automatically. Auto-answer modems are the data equivalent of answer-phones! They can be set to answer the phone automatically and tell the computer that data is being transmitted.

A term you'll hear mentioned in connection with both types of modem is baud rate. That's a measure of the speed at which data is transmitted. Think of it as bits-per-second, though this is a less than totally accurate definition — for reasons we'll come to in a moment. The two most common baud rates are 300 and 1200/75 (the latter meaning that data is received at 1200-baud, and transmitted at 75). Until recently, most modems could only operate at a single baud rate. Since the beginning of this year, however, a number of multiple-standard modems have appeared on the market at suitably bewitching prices. These can be switched

Two typical modems: acoustic and hard-wired





Top: A schematic view of communications using an acoustic modem (sometimes known as an acoustic-coupler). Above: Schematic of a hard-wired modem.

PHOTOGRAPHY IAN McKINNELL TANDY ACOUSTIC-COUPLER/MINOR MIRACLES WS2000 MODEM

between different baud rates.

1200/75-baud is used for viewdata systems like Prestel. That rate was chosen because the system is primarily designed for transmitting information to the user, rather than the other way around. For the most part, the user is only transmitting page numbers, so the snail-like transmission speed is acceptable.

The 300-baud standard — where transmission and reception are taking place at the same speed — is used where roughly equal amounts of data are passing in each direction. There are two 300-baud standards — the CCITT (or V23) used in Europe, while Bell standards are used in the USA. The difference between the two is simply a matter of variations in frequency.

If computers are going to be able to communicate, then some kind of standard is needed for representing the data. Fortunately, we already have a widely-accepted code: the American Standard Code for Information Interchange, or ASCII. Before ASCII data can be transmitted, it must be broken down into binary form. For example, to transmit an upper-case 'A', it must first convert the letter into its ASCII code, 65. This decimal value is then converted into 8-bit binary form — in this case, 01000001. These are known as data-bits, where ones are represented by one wavelength, and zeros by another.

Both the host computer and terminal need to know where one character ends and the next one begins, so breaks between characters are usually signified using stop-bits. A stop-bit is simply an agreed signal; when the computer receives this signal, the software knows that this is the end of a character, and can thus decode the preceding data-bits (see Figure 3 — and don't worry about the parity-bit for the moment). The most common protocol for communications is eight data-bits and one stop-bit. An alternative setting used by some systems is seven data-bits and two stop-bits. Other systems have both start-bits and stop-bits and use the change from one to the other as indication of the break.

You may remember my mentioning earlier that bits-per-second is not a completely accurate definition of baud rate. This is because start- and stop-bits have to be taken into account; for every 8 bits transmitted, only between five and seven bits will contain useful information. Thus the number of data-bits transmitted per second will be lower than the baud-rate.

Simple isn't it... isn't it? Well, not really, because of course there's an exception. Just to confuse things further, there's a protocol known as synchronous communications. This uses its own system of error-checking — there's no need for start- or stop-bits, and thus the baud rate is an accurate measurement of the speed of data-transmission. Synchronous communications tends to have rather specialised applications, though, and it's not supported by public-access systems.

Figure 3 refers to a parity-bit. Parity, which can be either odd or even, is a crude form of error-checking. Communication by phone is not totally reliable (my understatement of the month) and crackles which may be annoying during a conversation can totally confuse a computer. Under an 'odd' parity system, the number of high-bits is counted and an extra bit is then added just before the stop-bit to make the total number of high-bits even. To make sense of that rather inscrutable statement, look again at Figure 3. The binary number 01000001 contains two high-bits, so to make the total number of high-bits odd, the parity-bit must be set to 1 as well. An 'even' parity system is similar, but the total number of high-bits is set to even (!).

The parity-bit enables the computer to check that the incoming data is valid. If an odd-parity system is used, and the total number of high-bits is even, then the computer knows that the character was not transmitted correctly and it will request re-transmission. Parity-checking is not infallible. It will detect an error in a single data-bit, but an error in two data-bits would go undetected as the parity would be correct.

Systems and Boards

The term 'public-access systems' refers to computers which anybody can use. They divide into free public access systems (where no money passes hands) and commercial systems, where subscription and/or usage charges are made. Bulletin-boards are an example of free public access systems, while Prestel and Telecom Gold are the commercial equivalent.

Bulletin-boards (often abbreviated to BBs or just plain boards) are usually run by hobbyists on micros. Most are open to all comers. The main purpose of a bulletin-board is to allow users to leave public messages. These are going to range from requests for technical help — through fun messages — to matters of great political debate! Anyone can read, write and reply to messages. Other facilities offered will depend very much on the board, but most allow private messages to be sent from one user to another (electronic mail, or E-mail). Other features supported by many boards include news and gossip, downloading of public-domain software and the ability to run Basic programs like *Eliza*.

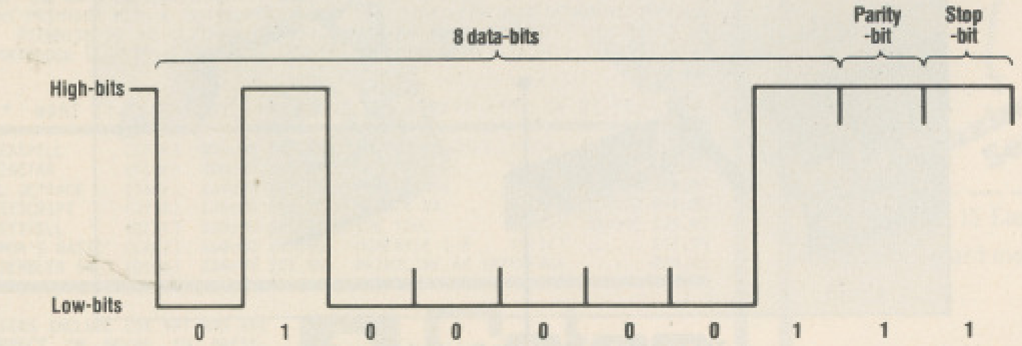
Some boards are run using home-brew programs, but most use either TBBS or CBBS software. Although both systems can be customised, they are reasonably consistent so far as structure and commands are concerned.

On your first call, you'll get long introductory messages and explanations. As you get used to the system, you can gradually reduce the amount of help given. Real masochists can switch off TBBS help altogether, leaving you with a terse 'Command:'!

Prestel is the public-owned viewdata system run by British Telecom and it's primary purpose is to provide the user with up-to-date information on things like news, weather, timetables and so on. The trendies amongst us also like to stun their neighbours by making credit card bookings and using it to purchase a limited range of goods and services.

Prestel's main area of interest to computer hobbyists is known as Micronet 800. There you'll find free public-domain programs for downloading, special offers on commercial software and more. The Commodore 64 user area is not quite ready at the time of writing, but should be by the time you read this. Further information from Micronet 800 on 01-278 3143. Telecom gold, on the other hand, is primarily aimed at business users. Although it does offer a range of services, its main purpose is to provide electronic mail facilities. Beware it's very expensive. Details from Telecom Gold on 01-403 6777.

Transmitting a letter 'A' using 8 Data-bits, 1 Stop-bit and odd parity



Binary 01000001 = Decimal 65 = ASCII "A"

Before a character can be transmitted over the telephone network, it is converted firstly to its ASCII code and then to the binary equivalent. The binary digits are then transmitted, sometimes followed by a parity bit (a crude checksum) and a stop-bit (to tell the computer that a complete character has been transmitted).

Beginning next month, Y64 will be running a complete list of all the UK bulletin-boards relevant to 64 users.

COMMS CHALLENGE!

SIX MODEMS TO BE WON

The Challenge

Computer communications offers a whole host of exciting possibilities: electronic mail, downloading software, shopping by phone, access to up-to-the minute news and instant credit-card bookings to name but a few.

But these are all established applications. What we'd like you to do is to come up with a new use for communications. It could be anything from a simple system involving a single micro, to a more adventurous idea requiring a larger computer system. But remember, what we're looking for is something innovative and original, not a minor variation on something that's been done before.

The idea must be genuinely useful, and be practical using existing technology. Aside from that, anything goes! We'd like a few hundred words describing the idea, how it would work and why it would be useful. We'll take the three most interesting ideas and try to turn them into reality. All rights to commercial exploitation of the idea remain your property.

The Incentive

The three entrants who, in the opinion of the judges, submit the most interesting new ideas will each receive a VTX modem with free 12-month subscription to Micronet 800, *plus* a Commodore Communications modem with a free 12-month subscription to Compunet. In addition, these three and the next ten runners-up will each receive a year's subscription to *Y64*.

The VTX modem can be used with any 1200/75-baud system, though the communications software is designed with paged viewdata systems (like Prestel) in mind. The communications cartridge supplied with the modem allows you to download software, as well as access other areas of Prestel.

Micronet 800 represents about 25 per cent of the Prestel database, offering news, reviews, technical information, public-domain and commercial software, shopping-by-phone and user-group areas. The Commodore 64 section is expected to be ready by the time you read this.

The **Commodore Communications modem** is a 1200/75-baud modem designed exclusively for Commodore's own viewdata system, Compunet. Compunet software is built into the modem.

Compunet is a viewdata system intended solely for 64 users. It offers shopping-by-phone, downloadable software, services and information and allows you to upload your own software for sale to other users. The service is launched this month.

The Judges

Surya our editor, is a keen bulletin-board enthusiast. He was formerly the programs editor of **Personal Computer World.**

John Newgas is the system operator of TBBS London, one of Britain's busiest bulletin-boards.

Ian Rock is the marketing manager of Micronet 800, and one of those responsible for setting up the 64 database.

Mark Horne is Commodore's product manager, responsible for marketing the modem and Compunet service.

The Rules

1. All entries must be typed or printed clearly. Illegible entries will be disqualified.
2. Please summarise your idea in the first paragraph. Then go on to explain how it would work, and outline the major benefits.
3. All material sent will be retained, and may be published without further permission.
4. The decision of the judges is final. No correspondence will be entered into either during or after the competition.
5. All entries must be received by September 30th. Entries arriving after this date will not be considered.

Address entries to:
Comms Competition, Your 64,
14 Rathbone Place, London W1P 1DE.

SPRITE LOGO

ICON STYLE

Edinburgh University's Marlene Kliman explains why Commodore's Sprite Logo is an ideal language for graphics programming, and describes a project to allow children as young as five to program an icon-driven turtle-graphics package written in the language.

Sprites are multiple interacting turtles that can take on different shapes, sizes and colours — and they are a welcome enhancement to Logo. For youngsters, sprites undoubtedly make Logo programming a more lively and exciting activity; they provide a quick and easy way of creating colourful on-line races, animation, games and simulations. The sprite section of *The Commodore 64 Logo Tutorial* (supplied with the package) gives several examples of sprite programs that are simple to write, fun to use, and easy to change into something more complex and interactive.

Perhaps less well-known is Sprite Logo's ability to help the software designer. With just minimal effort, the novice Sprite Logo programmer can be creating a dynamic and interactive simulation in a fraction of the time it would take to write a similar program in another high level language.

Sprite Logo is an ideal modelling language in that it automatically provides objects — sprites — which can be controlled with just one or two words; they can be made to move, to change direction, colour, size and shape — or to disappear from the screen altogether. A 'collision detection' feature tells you when two sprites are touching or when a sprite is touching something that's been drawn on the graphics screen. Thus what may take tens or hundreds of lines of code in a 'spriteless' high level language like Basic or Pascal, may take only a few lines in Sprite Logo.

For example, the commands

```
READ "COLOURS
READ "ANIMALS
TELL :BUG
PENCOLOR :BLACK
HOME
```

first load a Commodore Logo built-in file (on the utilities disk) of colour variables, so that colour names rather than numbers can be used; next they load a built-in file of animal sprite shapes and animal variables; then finally they put a black bug at the centre of the screen. If the following procedure is run:

```
TO CRAWL
 FD 1
 IF TB? THEN SETSHAPE :BUTTERFLY
 PENCOLOR :ORANGE FLUTTER ELSE CRAWL
END
```

and FLUTTER is defined as:

```
TO FLUTTER
  REPEAT 3 [RT RANDOM 360 FD RANDOM 50
 REPEAT 3 [FD 5 BK 5]]
 END
```

then the bug crawls slowly forward until it hits something on the graphics screen (Figure 1 shows the bug crawling towards a tree), at which point it changes into an orange butterfly and flutters around the screen. Try writing something like this in under ten lines of Basic or Pascal!

The simulation above is of course a very simple one, although the few lines of code produce a great deal of on-screen action. With some imagination and a little extra code, the simulation can be made much more complex. For instance, suppose a cat was chasing the butterfly. While the butterfly fluttered around the screen, the cat might follow it from the ground (a base line towards the bottom of the screen), and then catch it if it flew low enough to come within reach.

The CHASE procedure below can cause a cat to do just this! The first three lines of code put a brown cat near the bottom of the screen. Figure 2 shows the cat and the butterfly together on the screen.

```
TELL :CAT
SETCOLOR :BROWN
SETXY —120 (—50)

TO CHASE
 SETX GET :BUTTERFLY [XCOR]
 IF NOT TS? THEN TELL :BUTTERFLY FLUTTER
TELL :CAT CHASE
END

TO GET :N :INFORMATION
 LOCAL "ANSWER LOCAL "CURRENT
 MAKE "CURRENT WHO
 TELL :N
 MAKE "ANSWER RUN :INFORMATION
 TELL :CURRENT
 OP :ANSWER
END
```

CHASE moves the cat to the same horizontal position as the butterfly and then uses the TS? (Touching Sprite?) primitive to check if the cat and the butterfly are actually in contact. If they are, the program ends — otherwise, the chase goes on. Since the butterfly moves randomly, the length of time required for the cat to catch it will vary from run to run. GET returns a piece of information about a sprite that is not currently being 'told' (in this case, the x co-ordinate of the butterfly). It does this by temporarily 'telling' the sprite from which the information is desired.

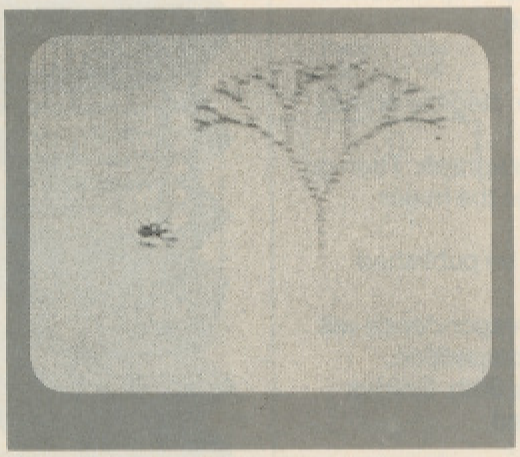


Figure 1: The bug (of the insect variety!) read in from the built-in ANIMALS file crawls toward the tree ...

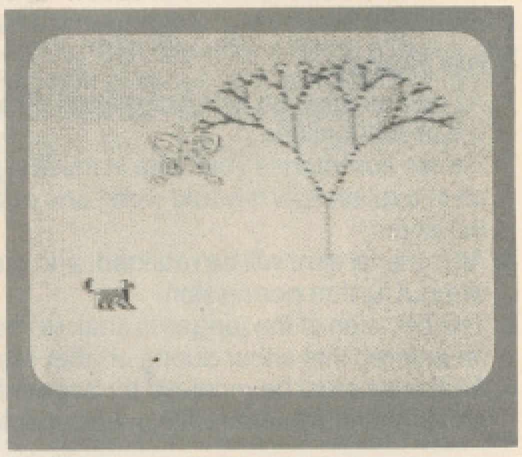


Figure 2: When it hits the tree, it changes into an orange butterfly and flutters around the screen — try doing that in under ten lines of Basic!

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SPRITE LOGO

Although children may enjoy watching this kind of simulation, interactive simulations can be much more fun and educational. Suppose, for example, that instead of moving randomly the butterfly flew in a particular geometric pattern that users could determine, and traced its path on the screen as it moved. The FLUTTER procedure might take the form:

```
TO FLUTTER :SIDE :ANGLE
 REPEAT 3 [RT :SIDE FD :ANGLE REPEAT 3
[FD 5 BK 5]]
END.
```

Values for the variables SIDE and ANGLE would be requested from users by an encompassing procedure which calls CHASE (which in turn calls FLUTTER). A mathematics teacher might use a simulation like this to give children a simple context for exploring polygonal spirals. At a more advanced level, children could measure relative distances between points on the polygonal spiral if they were allowed to enter the distance that the cat could 'jump' in order to catch the butterfly.

The Way Ahead

Of course, many more complex mathematical activities can be evolved from the cat and the butterfly routine, but the simulation could also provide the basis for explorations in other areas — in biology, for example. Although the cat moves in response to the butterfly, a more realistic predator-prey relationship would exist if the butterfly moved in response to the cat as well. The butterfly's motion might also depend on the location of food sources, or on the presence or absence of other amenities or adversities for either the cat or the butterfly. These factors could be determined by the users, and Sprite Logo could provide an environment for ecological and environmental simulations.

Another ideal domain for Sprite Logo is physics. For instance, we can have interactive simulations of planets (each a sprite) moving in orbit and becoming apparently larger or smaller (sprites can change shape) as their distance from an observer changes; or perhaps balls bouncing and colliding — both with each other and a floor and wall (thanks to collision detection), with resulting changes in velocity! Users would be allowed to change parameters to see how the new system behaves, perhaps aided in observation by an accompanying on-line velocity meter or speedometer.

Although scientific subjects may seem the most obviously appropriate application area for Sprite Logo simulations, the language can also be used to create educational and creative learning environments in the arts and humanities. For example, a troupe of sprite 'actors' can deliver a visual interpretation of an on-line poem or story, giving concrete meaning to new words and phrases encountered by early readers. Sprites can be choreographed (64 computers can add music too), used to construct on-line objects and designs, and arranged on 'music paper'. Since sprites can be controlled by input devices like joysticks, users of sprite-based programs need not be held back by having to learn a complex series of commands — or frustrated by the endless typing-in of lines of code in order to work a simulation. They are left free to concentrate wholly on the subject matter of the simulation.

Sprite-based interfaces, however, can do more than just save time and trouble. They also allow people access to software that they would never otherwise have the opportunity or ability to use. For example, using Sprite Logo, an inconographic, joystick-driven interface to the Logo programming language (described in more detail below) has been created for young and handicapped children who cannot read or type.

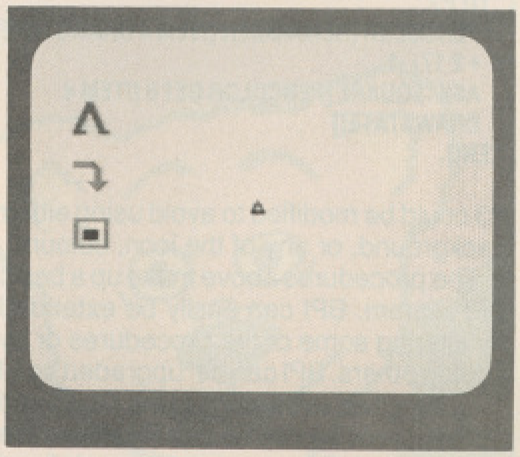


Figure 3: The BPI screen layout. The green triangle is the turtle itself, the walking legs represent forward movement, the right arrow a 90 degree turn. The green square in the box shows the current pen colour, and the currently-active icon is highlighted in red.

Such interfaces are sorely needed. Recent years have seen more and more computers appearing in primary schools and the consequent development of programming languages and other software for young children. Unfortunately, much of what currently exists cannot always be used by the audience for which it was intended. Often such skills as letter, number, or word recognition, memorisation of commands, or location of keys on a keyboard have to be mastered before a pupil is able to proceed fluently with a particular piece of software — without having to call for outside help. Even Logo, a language designed to be especially simple for young children to use, can be off-limits to those who have difficulty recognising letters or using a keyboard.

Attempts to avoid some of these problems have centred on using touchpads (or other touch-sensitive surfaces) as input systems in place of keyboards; these represent the commands as letters or symbols on the touchpad overlay. Touchpads, though, can be limiting. They are usually expensive, and not flexible enough to be used for programming. Also, since most touchpads are unable to display output from the computer, they cannot be used to represent changing information.

As easy as PI

A sprite-based interface that uses a joystick offers a far more pragmatic and versatile approach. The iconographic interface to Logo mentioned above was developed as part of my own research project. The idea was to develop a computer-based environment that young and handicapped children could use for creative mathematical work — at the Artificial Intelligence Department of the University of Edinburgh. The interface, called PI (for Programming Icons), uses five basic icons (each a sprite) — one for each of the Logo primitives FORWARD, RIGHT TURN, PEN COLOR, and CLEAR SCREEN, and a further one for saving procedures. These icons appear on a screen menu, and are selected and executed with the joystick. New procedures can be created by saving combinations of icons and representing them on the menu with a new icon. PI is unique in that its use requires no reading, number, or typing ability. It's operated entirely with a joystick.

Although PI was tested and found appropriate for a sample of six- and seven-year-old children, a simplified version has now been developed for even younger children. This version, called BPI (for Baby PI) uses only icons for FORWARD, RIGHT TURN, and PEN COLOR. The menu and input system for both PI and BPI can be created using just a few short procedures. Let's look now at how BPI operates (PI, by the way, works in a similar manner).

Figure 3 shows the BPI screen layout. At any particular time, one of the three icons on the menu will be the 'active' icon; when the joystick button is pressed, the turtle performs the action associated with that active icon. It appears in red, to distinguish it from the other two icons on the screen (coloured blue). When the forward icon (a pair of walking legs) is active and the joystick button is pressed, the turtle moves forward. When the right turn icon (an arrow bending to the right) is active and the joystick button is pressed, the turtle turns to the right. When the pen colour icon (a square frame with a smaller square inside) is active, only the frame turns red. The inner square shows the current pen colour, green in figure 3. When this icon is executed, the colour cycles to the next in the group of possible pen colours, and the inner square of the icon changes colour appropriately. The joystick lever cycles through the icons, changing whichever is active. When the joystick lever is pushed down, the active icon is deactivated and it changes colour to blue; the next icon in the menu turns red and becomes active. Likewise, when the joystick lever is pushed up, the active icon is deactivated and the next highest icon in the menu, activated.

The following procedure sets up the icons as shown in Figure 3 and then calls on MAINLOOP, the main loop of BPI. Variable names are used to indicate the appropriate sprite numbers.

```
TO SETUP
 ASK: LEGS [PENCOLOR: R D SETXY -120 80]
```

SPRITE LOGO

```
ASK: ARROW [PENCOLOR: BLUE SETXY -100
30]
ASK: FRAME [PENCOLOR: BLUE SETXY -100
(-20)]
ASK: SQUARE [PENCOLOR: GREEN SETXY -100
(-20)]
TELL 0 PENCOLOR: GREEN HOME
MAINLOOP
END
```

ASK is similar to the procedure GET defined above. ASK allows a sprite that is not currently being 'told' to carry out a list of commands.

```
TO ASK: N :COMMAND.LIST
  LOCAL "CURRENT
  MAKE "CURRENT WHO
  TELL: N RUN: COMMAND.LIST
  TELL: CURRENT
END
```

MAINLOOP is given below. It uses joystick 0, although joystick 1 could just as easily be used. Variables UP and DOWN have the values -1 and 1 respectively. Variables TOPICON and BOTICON have the values 1 and 3 respectively, and represent the sprite numbers of the top and bottom icons in the menu.

```
TO MAINLOOP
  IF JOYSTICK 0=0 THEN IF :ACTIVE >
  :TOPICON THEN CYCLE :UP
  IF JOYSTICK 0=4 THEN IF :ACTIVE < :
  BOTICON THEN CYCLE :DOWN
  IF JOYBUTTON 0 THEN RUN (LIST WORD "P:
  ACTIVE)
  MAINLOOP
END
```

MAINLOOP checks to see if the joystick lever is being pressed up or down or if the joystick button is depressed. If the lever is being pushed, and appropriate boundary conditions are met, CYCLE is called on to make a new icon current.

```
TO CYCLE :DIR
  ASK :ACTIVE [PENCOLOR :BLUE]
  MAKE "ACTIVE :ACTIVE + :DIR
  ASK :ACTIVE [PENCOLOR :RED]
END
```

If the joystick button is depressed, MAINLOOP calls for the active icon to be executed. It does this by running one of the procedures P1, P2 or P3 — each of which corresponds to one of the three icons. For example, if sprite 1 is the forward icon, then P1 would make the turtle move forward. It's up to the software designer to determine how many steps the turtle will take each time it moves forward. A larger number will make the turtle motion more clear and concrete for the young PI or BPI user; it also limits the intricacy of the designs that can be created. Between 5 and 20 turtle steps per move forward is generally appropriate. For example:

```
TO P1
  FD 10
END.
```

Of course if the turtle was allowed to wander all over the screen, it might run slap into the menu area. To avoid this, a section of the screen could be designated just for the turtle; you can incorporate a check into P1 to make sure that the turtle moves only within this area.

Just as a larger number of steps will make turtle motion more concrete — but at the same time will limit design possibilities — a larger angle of rotation will make turtle turning easier to understand, but also more restrictive. A rotation of 30, 45 or 90 degrees is best for a beginner. For example:

```
TO P2
  RT 45
END.
```

The pen colour procedure is also somewhat open-ended, and it's up to the software designer to determine exactly which colours the turtle can use for drawing. The following procedure permits use of any of the Logo pen colours, including -1, the eraser colour:

```
TO P3
  PENCOLOR (REMAINDER (ITEM 4 DRAWSTATE)
  + 2 17) -1
  ASK :SQUARE [PENCOLOR GET 0 [ITEM 4
  DRAWSTATE]]
END.
```

P3 could be modified to avoid using either background, or any of the icon, colours.

The procedures above make up a basic BPI system. BPI can easily be extended by altering some of the procedures or by adding others. BPI can be 'upgraded' to PI by adding two extra icons to the menu and defining procedures so that P4 clears the screen and P5 saves a user-defined procedure.

Customer Feedback

Version of BPI and PI have been tested with several children of varying abilities and backgrounds, aged between five and nine. The versions involved used the icons shown in Figure 3 to move and draw on a grid of large squares — via a turtle that's shaped like a grid square with an arrow in it. Testing confirmed that a sprite-based inconographic interface to Logo can be a very successful way of getting children to use the computer for creative mathematics. Almost all of those involved became fluent users of BPI after working with it for about 15 minutes; after a couple of hours, many of them were already using PI to write their own procedures!

Even the youngest children seemed to have no trouble understanding procedures. Since a 'name' for a PI procedure is automatically created as an icon-sized version of the screen picture it represents (for example, a procedure that draws a square is automatically named with a similar square icon), children were able to identify procedures by their shapes. Since the icons representing the procedures they created all appeared on the menu, they were spared the frustration of forgetting what particular procedures were called, or what they did. This simplification was especially helpful to the youngest children.

PI's success is largely due to Sprite Logo. Because the language's code is so easy to write and change, revisions can quickly be made in response to observation. During preliminary testing, I spent mornings using BPI and PI with children, and afternoons making (sometimes major) revisions in the controls of the system, and creating on-line activities that the children could use the next day. The speed with which changes could be made led the children themselves to offer helpful suggestions of how certain of the activities could be made more interesting — or how the controls of the system could be made easier to use. Many of their suggestions turned out to be quite valuable and were incorporated into the program.

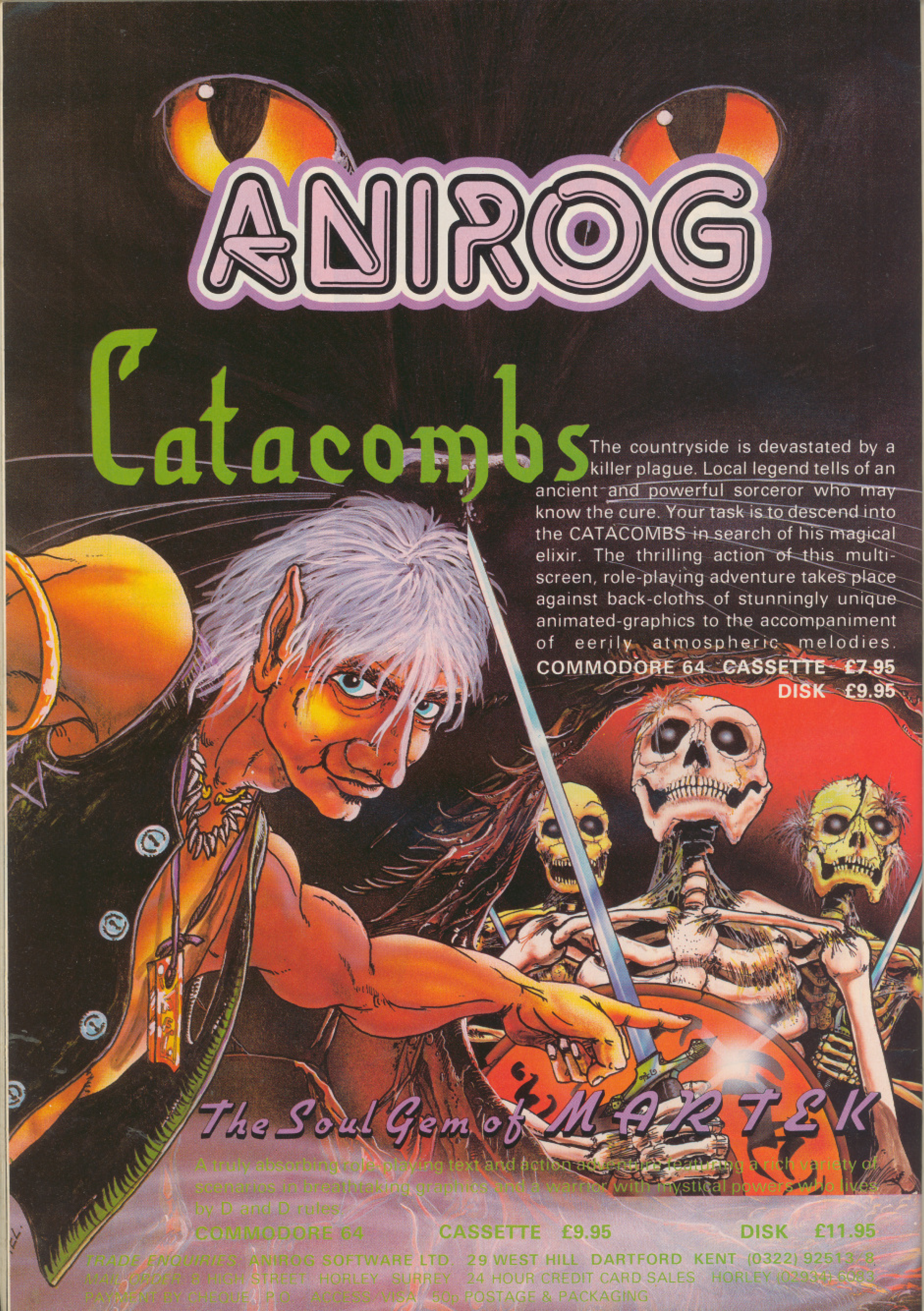
As more and more microcomputers are developed with built-in sprite capabilities, and languages such as Sprite Logo are developed, a new generation of educational software will emerge. The software of the future will be adaptable, interesting, and useful in a variety of educational domains. It will certainly be more tailored to the needs of individual users, more flexible, more visual, and much more user-directed than traditional computer-assisted instruction.

Thanks must go to the Princes Street, Edinburgh branch of W H Smith for its kind loan of equipment used in the writing of this article.



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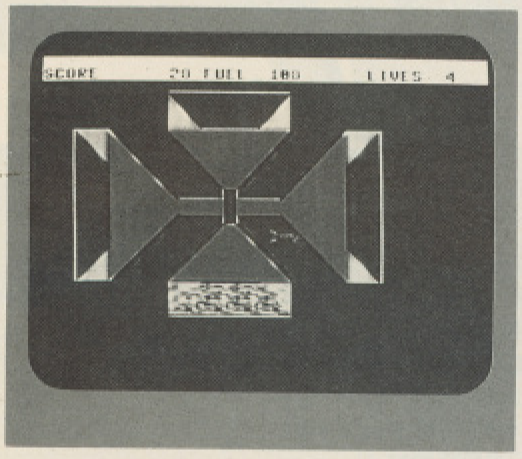
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Each alien passing you will drain some of your ship's power. The game ends when your power is exhausted. Full instructions are contained within the program.




```
10 REM ******************************
11 REM **                          **
12 REM **      ENERGY FIELDS       **
14 REM **      ADAPTED FOR THE     **
16 REM **      COMMODORE 64        **
18 REM **         BY               **
20 REM **      D.A.PONTING         **
22 REM **       22/7/83            **
24 REM **                          **
26 REM ******************************
```

Line 50-136 Read in character DATA from ROM for use in the initial display.

```
50 DIMLTR(20,7)
100 A1$="ENERGY FIELDS":S=54272:V=53248:
SC$="000":LI$="5":MO=1.1
107 PO$="80":POKE56334,PEEK(56334)AND254
109 POKE1,PEEK(1)AND251
110 FORC1=1TOLEN(A1$)
115 FORT=0TO7
120 LTR(C1,T)=PEEK((ASC(MID$(A1$,C1,1))-
64)*8+53248+T)
130 NEXTT,C1
132 POKE1,PEEK(1)OR4
134 POKE56334,PEEK(56334)OR1
136 GOSUB2000
```

Line 200-298 Initial screen graphic display. The data for each letter is read into a sprite shape; the sprite is then moved into position on the screen. Then GOSUB 400 PRINTs the same character into the position- The loop repeats until all of the title is displayed.

```
200 REM *  POSITION SPRITE *
201 FORT=0TO63:POKE832+T,0:NEXTT
202 X=104:Y=255:REM *** INITIAL POSITION
 ***
203 SP$="████████████"
204 SQ$="██████████"
205 FORTT=1TO13
210 FORT=0TO7
220 POKE832+(T*3),LTR(TT,T):REM *** SPRI
TE SHAPE DATA ***
230 NEXTT
235 POKEV,X:POKEV+1,Y
240 POKE2040,13:REM SPRITE 0
250 POKEV+21,PEEK(V+21)OR1 :POKEV+39,5
280 FORY=2TO66STEP4
290 POKEV,X:POKEV+1,Y
295 REM  IFY=24THENGOSUB400
296 NEXTY:GOSUB400:Y=24:X=X+8:NEXTTT
297 GETQQ$:IFQQ$=""THEN297
298 GOSUB600:GOSUB900:GOTO730
```

Line 300-390 Graphic and sound display to fire an energy field over the tube exit.

```
300 REM ****** FIRE ENERGY FIELDS ******
301 POKE2044,64:POKE2043,64:POKE2045,64:
POKE2046,64:V=53248
302 POKEV+21,PEEK(V+21)OR120:POKEV+28,PE
EK(V+28)OR120
303 X1=X2:Y1=Y2
304 POKEV+6,XX:POKEV+7,YY
305 POKEV+8,XX+X1:POKEV+9,YY+Y1
310 POKEV+10,XX+2*X1:POKEV+11,YY+2*Y1
315 POKEV+12,XX+3*X1:POKEV+13,YY+3*Y1
320 POKEV+42,X/2:POKEV+43,X/2:POKEV+44,X
/2:POKEV+45,X/2
325 POKEV+38,X1+Y1:POKEV+37,X1+Y1+7
328 POKES+4,33:FORTT=1TO3:FORT=25TO75:PO
KES+1,T:NEXTT,TT:POKES+4,0
330 POKE16320+3*(X1+Y1),INT(RND(1)*256)
331 POKE16321+3*(X1+Y1),INT(RND(1)*256)
332 POKE16322+3*(X1+Y1),INT(RND(1)*256)
335 GOSUB930
340 POKEV+30,0
345 IFCH=KTHENSC=SC+20:GOSUB380:GOSUB110
0:GOTO900
350 LI=LI-1
355 POKES+4,33:FORT=1TO50
357 POKE2040,T:POKEV+39,T:POKES+1,20:POK
ES+1,40:POKES+1,60:POKES+1,80
360 NEXTT:POKES+4,0:POKE2040,13:POKEV+39
,5:GOSUB1100:GOTO900
380 POKES+4,17:POKES+11,33:FORTT=1TO5:FO
RT=1TO255STEP16
385 POKES+8,(256-T):POKES+1,T
390 NEXTT,TT:POKES+4,0:POKES+11,0:RETURN
```

Line 400-412 PRINT each character of the title onto the screen.

```
400 PRINT"████";SP$;:SP$=SP$+"█"
402 PRINTMID$(A1$,TT,1);:POKEV+21,PEEK(V
```

```
+21)AND0:RETURN
410 PRINT"";SQ$;:SQ$=SQ$+""
412 PRINTMID$(A1$,TT,1);:POKEV+21,PEEK(V
+21)AND253:RETURN
```

Line 500-525 Initialize SID registers.

```
500 REM *** SOUND ***
502 S=54272:FORT=0TO28:POKES+T,0
505 POKES+24,15
507 POKES+5,63:POKES+6,200:POKES+19,12:P
OKES+20,240
510 POKES+4,96:POKES+1,20
515 POKES+18,65:POKES+12,63:POKES+13,200
525 RETURN
```

Line 600-700 Set up screen colours. PRINT the game screen. You should be particularly careful when typing in lines 604-720.

```
600 POKE53281,11:POKE53280,11:PRINT"";
601 PRINT"
         ";
602 PRINT"SCORE      "TAB(10-LEN(SC$))S
C$" FUEL "TAB(22-LEN(PO$))PO$;
603 PRINT"       LIVES "TAB(35-LEN(LI$))
LI$"         "
604 PRINT"              ____________      "
606 PRINT"
"
608 PRINT"
"
610 PRINT"
"
620 PRINT"
   "
625 PRINT"  |
    |"
630 PRINT"  |
       |"
635 PRINT"  |
      |
640 PRINT"  |
      |
645 PRINT"  |            |  |
      |
650 PRINT"  |
      |
655 PRINT"  |
      |
660 PRINT"  |
      |
665 PRINT"  |
      |
670 PRINT"  |
       |"
675 PRINT"  |
      |
680 PRINT"
      "
685 REM PRINT"              /           \
690 REM PRINT"              /           \
695 PRINT"
700 PRINT"
705 PRINT"
710 PRINT"
720 RETURN
```

Line 730-740 Read in the DATA and set the sprite pointers and initial positions.

```
730 RESTORE
732 FORW=0TO191:READQQ:POKE832+W,QQ:NEXT
W:POKE2040,13:POKE2046,14:POKE2047,14
735 X=200:Y=96:V=53248:SC=0:LI=5:PO=100
740 POKE2040,13:POKEV+21,PEEK(V+21)OR1:G
OSUB500
```

Line 750-899 Move the spaceship sprite in response to keyboard controls.

```
750 REM **** SPRITE MOVEMENT ****
752 POKES+14,255-Y:POKES+15,3:POKES+16,Y
755 AA$=""
760 GETAA$:IFAA$=""ANDY<232THENY=Y+4:X=
X+8
765 IFAA$=""ANDY>48THENY=Y-4:X=X+8
766 IFX=>254THENX=0:MSB=1:POKEV+16,PEEK(
V+16)OR1
767 IFX>90ANDMSB=1THENX=0:MSB=0:POKEV+16
,PEEK(V+16)AND254
768 A$="":GETA$:IFAA$=" "THENGOSUB1000
770 POKEV,X:POKEV+1,Y
775 POKEV+42,X/2:POKEV+43,X/2:POKEV+44,X
/2:POKEV+45,X/2
780 GOSUB930:GOTO750
899 RETURN
```

Line 900-927 Set the initial position of the enemy and RANDomly choose its direction of travel along the tube system.

```
900 REM ***** SET-UP INTIIAL ENEMY POSIT
ION AND DIRECTION ****
905 POKEV+27,PEEK(V+27)OR 128:POKE2047,1
4:POKEV+21,PEEK(V+21)OR128
907 POKEV+46,8:MO=MO+0.05
910 CH=INT(RND(1)*4)+1:E=144:F=136
920 DE=MO*(CH=1)-MO*(CH=2)
925 DF=MO*(CH=3)-MO*(CH=4)
927 POKE198,0:RETURN
```

Line 930-950 Increment the position of the alien.

```
930 E=E+DE:F=F+DF:POKEV+14,E:POKEV+15,F
935 IFE<70ORE>190ORF<110ORF>170THENPOKE2
047,15
940 IFE<45ORE>240ORF<74ORF>210THENLI=LI-
1:GOSUB1100:GOSUB960:GOTO900
950 RETURN
```

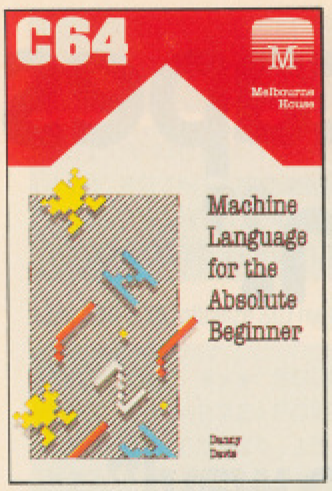
Line 960-980 Sound effect if enemy escapes from the tube system.

```
960 REM **ENEMY ESCAPES SOUND***
961 S=54272
962 POKES+4,33:FORT=1TO10
964 POKES+1,100:GOSUB980:POKES+1,70:GOSU
B980:POKES+1,50:GOSUB980
968 NEXTT:POKES+4,0
980 FORDL=1TO50:NEXT:RETURN
```

Line 1000-1199 Position the energy field over an exit to the tube system.

```
1000 REM ***  LAY ENERGY SHIELD ***
1005 X2=0:Y2=0:IFMSB=1THEN1020
1010 IF(X>25ANDX<45)AND(Y>82ANDY<168)THE
NY2=21:K=1:XX=48:YY=106:GOTO300
1020 IF(X>220ANDX<240)AND(Y>82ANDY<168)T
HENY2=21:K=2:XX=240:YY=106:GOTO300
1030 IF(X>52ANDX<150)AND(Y>54ANDY<84)THE
NX2=21:K=3:XX=112:YY=76:GOTO300
1040 IF(X>52ANDX<150)AND(Y>186ANDY<216)T
HENX2=21:K=4:XX=112:YY=204:GOTO300
1050 PO=PO-5
```


"No way!"



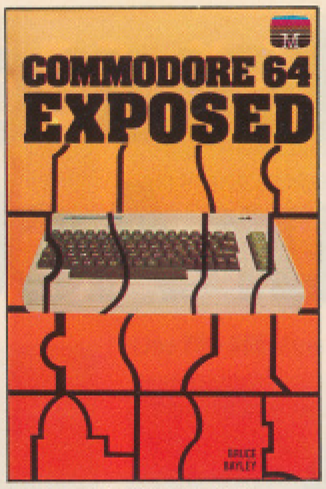
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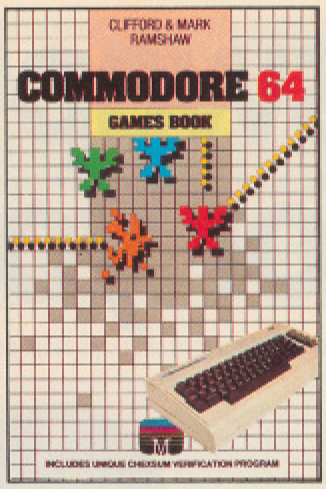


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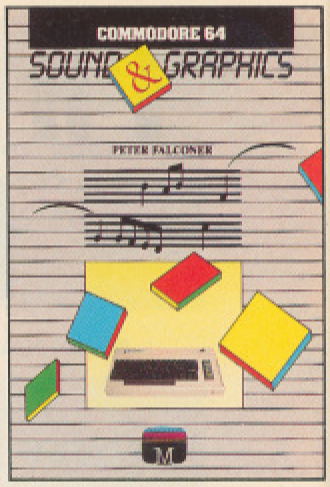
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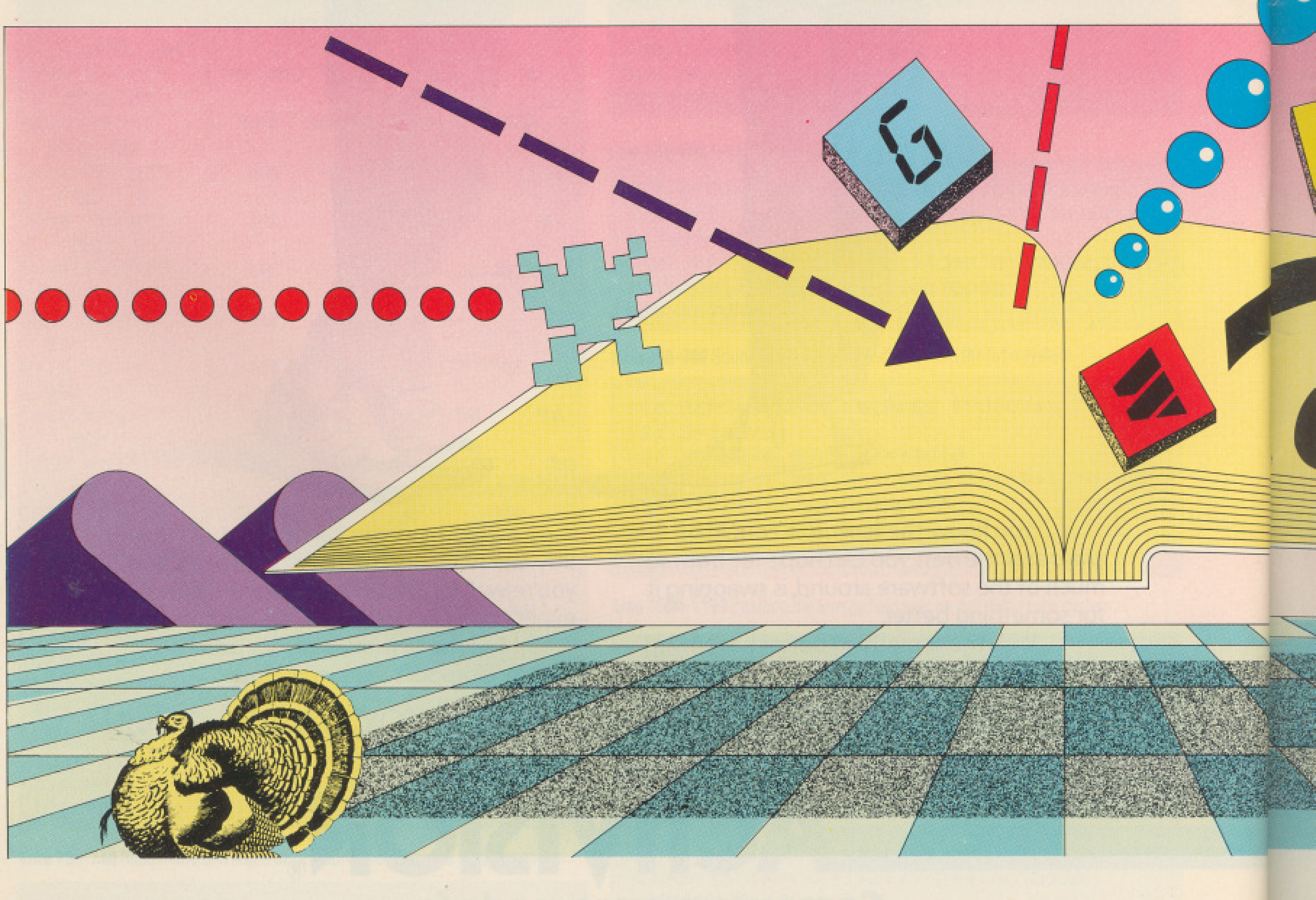
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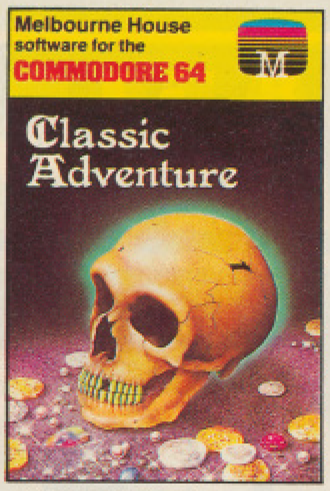
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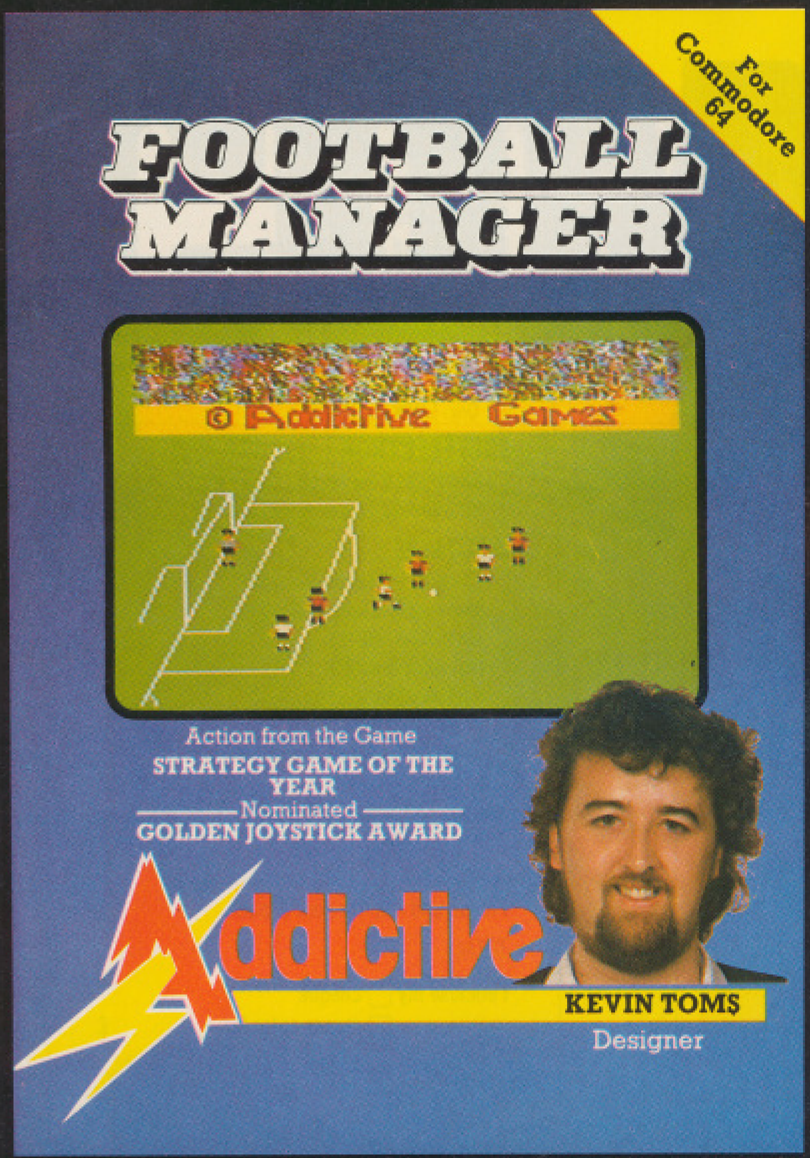
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```
1100 PO$=STR$(PO):LI$=STR$(LI):SC$=STR$(
SC)
1105 IFPO=<0ORLI=<0THENGOTO3000
1110 GOTO601
1199 PO=PO-5:GOSUB601:RETURN
```

Line 2000-2999 Instructions to play the game.

```
2000 REM *** INSTUCTIONS ***
2010 PRINT"■";:PRINT"■■■"
2020 PRINT"                ——————  ——————"
2030 PRINT"■ GUARD THE TUBE SYSTEM WITH
YOUR CRAFT"
2040 PRINT" BY SETTING UP ENERGY FIELDS
AT THE 4"
2050 PRINT" OPEN ENDS OF THE SYSTEM. ATT
EMPTING"
2060 PRINT" TO PLACE A FIELD AT ANY PLAC
E OTHER "
2070 PRINT " THAN THE END WILL RESULT IN
 POWER"
2080 PRINT " LOSS. SETTING ONE UP AT A T
UBE NOT "
2090 PRINT"  CONTAINING AN ENEMY WILL RE
SULT IN "
2100 PRINT" YOUR DESTRUCTION.
2120 PRINT"■ CONTROL YOUR CRAFT BY:-":PR
INT"          ■CURSOR UP ■ = UP
2130 PRINT"          ■CURSOR LEFT ■ = DOWN
2150 PRINT"                ■SPACE■ = FIRE
2160 PRINT"■ WHEN ALL OF YOUR FUEL IS US
ED OR ALL"
2170 PRINT" YOUR LIVES ARE LOST THE GAME
 IS OVER."
2200 PRINT"■■   PRESS ANY KEY TO START T
HE GAME"
2300 RETURN
2999 GOTO2999
```

Line 3000-3095 Graphic display for the end of the game. Offer choice of a new game.

```
3000 REM **** END OF GAME ****
3005 POKE53269,0:POKE198,0
3010 POKE53265,PEEK(53265)OR64
3020 PRINT"■":FORT=1TO500:NEXT:T=0
3030 PRINT"■■■■■■■■■■"
3040 PRINT"           ■               ■
"
3045 PRINT"           ■               ■
"
3050 PRINT"           ■   GAME OVER   ■
"
3055 PRINT"           ■               ■
"
3060 PRINT"           ■               ■

3070 PRINT"■■■■■■■     PRESS ANY KEY TO P
LAY AGAIN"
3075 POKE53283,T
3080 GETBB$:IFBB$=""THENT=-(T+1)*(T<256)
:GOTO3030
3090 POKE53265,PEEK(53265)AND191:POKE532
83,242
3092 SC=0:SC$="00":PO=100:PO$="100":LI=5
:LI$="5"
3095 GOSUB600:GOTO730
```

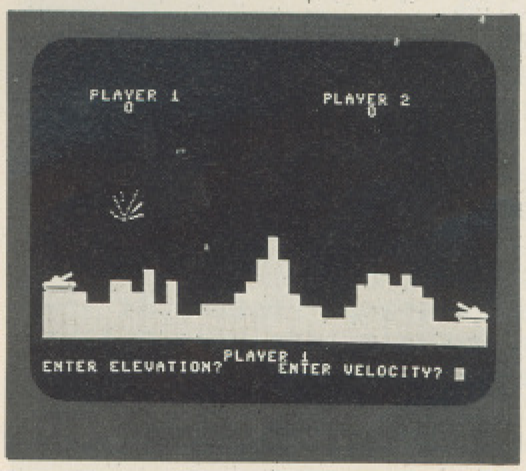
Line 20000-20230 Data for sprites' shapes.

```
20000 REM SPRITES' DATA **********SHIP**
*********
20010 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,224,0,0
20020 DATA248,0,0,124,0,108,63,255,216,6
1,221,255,63,255,252,124,0,120,120,0,32
20030 DATA224,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0
20100 REM ************* ENEMY 1 ********
******
20110 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0
20120 DATA0,0,0,60,0,0,189,0,0,219,0,0
,126,0,0,60,0,0,60,0
20130 DATA0,102,0,0,195,0,0,195,0,0,60,0
,0,24,0,0,0,0,0,0,0,0
20200 REM *** SPRITE ENEMY 2  ***
20202 DATA 6, 3, 0, 2, 2, 0, 1, 4, 0, 1,
 4, 0
20203 DATA 49, 140, 96, 127, 255, 240, 2
54, 113, 248, 140, 113, 136
20204 DATA 140, 113, 136, 127, 255, 240,
 31, 255, 192, 25, 152, 192
20205 DATA 25, 152, 192, 24, 0, 192, 25,
 140, 192, 15, 255, 128
20206 DATA 7, 143, 0, 1, 140, 0, 1, 140,
 0, 49, 140, 96
20207 DATA 63, 143, 224, 0
20210 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0
20220 DATA0,0,0,60,0,0,189,0,0,219,0,0
,126,0,0,60,0,0,60,0
20230 DATA0,102,0,0,195,0,0,195,0,0,60,0
,0,24,0,0,0,0,0,0,0,0
```

TANX

Tanx is a two-player game, each player controlling a gun on one side of a range of randomly-generated hills. The object is to destroy your opponent's gun, which you achieve by amassing the highest score after seven hits.

The gun is controlled by entering the angle and velocity of fire. The higher scores are achieved by using the smallest possible angle of elevation for a given velocity. At higher speeds, your fire may penetrate the hills. Instructions are given in the program.




```
10 REM ****************************
11 REM **                        **
12 REM **          TANX          **
13 REM **                        **
14 REM **   ADAPTED FOR THE      **
16 REM **        CBM 64          **
17 REM **                        **
18 REM **   BY DAVE PONTING      **
```

```
19 REM ** WRITTEN BY STANLEY     **
20 REM *****************************
```

Line 22-50 Initialize run-time variables. Randomly choose which player should go first and direct program control accordingly.

```
22 POKE53280,0:POKE53281,0:PRINT"█":AT$=
"████████████████████████████████"
24 GOSUB7000
25 SC(1)=0:SC(2)=SC(1)
27 GOSUB9000
30 C=0:GOSUB8000
35 IFRND(1)>.5THENC=C+1:GOSUB700
40 GOSUB100
44 C=C+1
45 IFC=8THENPRINT"█";:GOTO30
46 GOSUB700
47 C=C+1
48 IFC=8THENPRINT"█";:GOTO30
50 GOTO40
```

Line 100-132 Enter elevation and velocity for player 1. Check that the values are within the required range.

```
100 REM —!ER 1
105 PRINTLEFT$(AT$,22)SPC(16)"        "
110 PRINT"
         "
112 PRINT"
         "
115 PRINTLEFT$(AT$,23)SPC(16)"PLAYER 1"
120 A=-1:INPUT"ENTER ELEVATION";A$
122 IFA$<"0"ORA$>"90"THENPRINT"     ( 0-9
0 )";:GOTO115
130 PRINT"█████████████████████████";:INPUT
"ENTER VELOCITY";VEL
132 IFVEL<2ORVEL>10THENPRINT"████████████
█████████( 2-10 )";:PRINT"█":GOTO130
```

Line 135-167 Calculate the trajectory of the shell and use a sprite to display its movement.

```
135 POKESO+4,129:POKESO+18,129
140 MAX=120+5*VEL:A=VAL(A$)
145 E=A/10:E1=E/4:E2=E/16
146 S1=PEEK(V+1)-16
147 PP=PEEK(V+31):PP=PEEK(V+30):POKESO+4
,128:POKESO+18,128
148 POKEV+4,PEEK(V)+8:POKEV+5,S1:POKE204
2,11:POKEV+21,7
149 PP=PEEK(V+31):PP=PEEK(V+30):POKESO+1
1,33
150 FORG=32TO316STEPVEL
152 PP=PEEK(V+31):PP=PEEK(V+30):POKESO+1
1,33
155 POKESO+8,G/2
160 POKEV+4,G+255*(G>255):POKEV+5,S1
165 IFG>255THENPOKEV+16,PEEK(V+16)OR4
167 IFG<256THENPOKEV+16,PEEK(V+16)AND251
```

Line 170 Check for a hit on the ground.

```
170 IFS1>50THENIF((PEEK(V+31)AND4)=4)THE
NGOSUB300:G=316
```

Line 175-195 Check for a hit on tank 2.

```
175 IF((PEEK(V+30)AND2)=2)THENGOSUB400:G
=316
180 S1=S1+E*((G<MAX)AND(S1>30))-E*((G>=M
AX))
182 E=E+((E/8)*(G<MAX))-((E2)*(G>MAX-1))
190 NEXTG
192 POKESO+11,32
195 POKEV+21,3:RETURN
```

Line 300-399 Hit on the ground. Sprite graphics explosion and remove some of the hill.

```
300 REM HIT ON THE GROUND
305 POKE2042,15:POKESO+4,17:POKESO+11,33
:POKESO+18,129
310 FORT=1TO200:POKESO+1,T:POKESO+8,250-
T:NEXTT:POKESO+1,20
320 POKEV+21,3:POKESO+4,128:POKESO+11,12
8:POKESO+18,128
325 IFG<12THENG=12
330 PRINTLEFT$(AT$,(INT((S1+19)/8)-5))SP
C(INT((G+13)/8)-3)" "
399 GOTO8410
```

Line 400-449 Calling routine for a hit on the tank of player 2. GOTO end of game if total score is greater than 7.

```
400 REM HIT TANK 2
405 SC(1)=SC(1)+1
420 GOSUB300
430 IFSC(1)+SC(2)=7THEN1000
449 GOTO8000
```

Line 450-499 Calling routine for a hit on the tank of player 1. GOTO end of game if total score is greater than 7.

```
450 REM HIT TANK 1
455 SC(2)=SC(2)+1
460 GOSUB300
480 IFSC(1)+SC(2)=7THEN1000
499 GOTO8000
```

Line 700-732 Enter elevation and velocity for player 2. Check that both are within the required range of values.

```
700 REM —!ER 2
705 PRINTLEFT$(AT$,22)SPC(16)"        "
710 PRINT"
         "
712 PRINT"
         "
715 PRINTLEFT$(AT$,23)SPC(16)"PLAYER 2"
720 A=-1:INPUT"ENTER ELEVATION";A$
722 IFA$<"0"ORA$>"90"THENPRINT"     ( 0-9
0 )";:GOTO715
730 PRINT"█████████████████████████";:INPUT
"ENTER VELOCITY";VEL
732 IFVEL<2ORVEL>10THENPRINT"████████████
█████████( 2-10 )";:PRINT"█":GOTO730
```

Line 735-780 Calculate the trajectory of the shell and use a sprite to display its movement.

```
735 POKESO+4,129:POKESO+18,129
740 MAX=200-5*VEL:A=VAL(A$)
745 E=A/10:E1=E/4:E2=E/16
746 S1=PEEK(V+3)-16
747 PP=PEEK(V+31):PP=PEEK(V+30):POKESO+4
,128:POKESO+18,128
748 POKEV+4,48:POKEV+5,S1:POKEV+16,PEEK(
V+16)OR4:POKE2042,11:POKEV+21,7
749 PP=PEEK(V+31):PP=PEEK(V+30):POKESO+1
1,33
```

```
750 FORG=304TO8STEP-VEL
755 POKESO+8,G/2
760 POKEV+4,G+255*(G>255):POKEV+5,S1
765 IFG>255THENPOKEV+16,PEEK(V+16)OR4
767 IFG<256THENPOKEV+16,PEEK(V+16)AND251
770 S1=S1+E*((G>MAX)AND(S1>30))-E*((G<=M
AX))
780 E=E+((E/8)*(G>MAX))-((E2)*(G<MAX-1))
```

Line 785 Check for hit on ground.

```
785 IF((PEEK(V+31)AND4)=4)THENGOSUB300:G
=8
```

Line 787 Check for hit on tank 1.

```
787 IF((PEEK(V+30)AND1)=1)THENGOSUB450:G
=8
```

Line 790-799 Complete movement loop, then RETURN from the subroutine.

```
790 NEXTG
798 POKESO+11,32
799 RETURN
```

Line 1000-1030 End of the game routine, allowing a new game to be played, or <RUN/STOP> will end your career as a tank commander.

```
1000 REM END OF THE GAME
1005 PRINTLEFT$(AT$,4)SPC(10)"THE BATTLE
 IS OVER"
1010 PRINTSPC(10)"■PRESS ANY KEY TO PLAY
 AGAIN"
1020 WAIT197,191
1030 SC(1)=0:SC(2)=0:GOTO30
```

Line 7000-7080 Initialise the screen.

```
7000 REM *** INITIAL SCREEN —| AND O¬WRU
CTIONS ***
7002 PRINT"■";:T1=0:T2=10:T3=27:T4=37
7005 FORT=18TO1STEP-1
7010 PRINTLEFT$(AT$,T)TAB(T1)"T"TAB(T2)"
A"TAB(T3)"N"TAB(T4)"X"
7020 IFT>1THENPRINTLEFT$(AT$,T)TAB(T1)"
"TAB(T2)" "TAB(T3)" "TAB(T4)" "
7030 T1=T1+1:T2=T2+.5:T3=T3-.5:T4=T4-1
7040 NEXTT
7045 T1=0:T2=10:T3=27:T4=37
7047 FORT=19TO2STEP-1
7050 PRINTLEFT$(AT$,T)TAB(T1)"—"TAB(T2)"
—"TAB(T3)"—"TAB(T4)"—"
7060 IFT>2THENPRINTLEFT$(AT$,T)TAB(T1)"
"TAB(T2)" "TAB(T3)" "TAB(T4)" "
7070 T1=T1+1:T2=T2+.5:T3=T3-.5:T4=T4-1
7080 NEXTT
```

Line 7150-7200 Display instructions at the beginning of the game.

```
7150 PRINT"■■THE TWO PLAYERS TAKE TURNS
TO ENTER THE  ANGLE AND VELOCITY AT ";
7155 PRINT"WHICH THEY WANT   TO FIRE TO
TRY TO HIT THEIR OPPONENT."
7160 PRINT"■THE SHELLS MUST BE FIRED OVE
R THE HILLS  BUT IF YOU ARE LUCKY YOUR";
7165 PRINT" SHELL MAY BE ABLE TO GO THRO
UGH A HILL";
7167 PRINT" (PARTICULARLY  AT THE HIGHER
 SPEEDS.)"
7170 PRINT"■THE WINNER IS THE PLAYER WHO
 HAS HIT HIS  OPPONENT THE MOST ";
7175 PRINT"AFTER A TOTAL OF 7  HITS HAVE
 BEEN MADE"
7180 PRINT"■  TO STAND THE BEST CHANCE O
F HITTING    YOUR OPPONENT TRY TO ";
7185 PRINT"USE THE SMALLEST   POSSIBLE A
NGLE OF ELEVATION."
7190 PRINT"■    ■ PRESS ANY KEY TO START
 THE GAME "
7195 A$="":GETA$:IFA$<>""THEN7195
7197 GETA$:IFA$=""THEN7197
7200 PRINT"■";:RETURN
```

Line 8000-8400 Draw the initial game screen of hills. Lines 8042 and 8045 ensure that there is a flat surface for each tank.

```
8000 REM *** INITOAL SCREEN SET-UP ***
8003 POKEV+21,0
8005 Q=20-INT(RND(1)*10)
8007 PRINT"■"
8010 FORF=0TO39
8020 FORG=21TOQSTEP-1
8030 PRINTLEFT$(AT$,G)SPC(F)"■■ "
8035 REM PRINTLEFT$(AT$,G)SPC(F-2)
8040 NEXTG
8042 IFF<3THENNEXTF
8045 IFF>36THENNEXTF:GOTO8100
8050 Q=Q+INT(RND(1)*4)-INT(RND(1)*4)
8060 IFQ<7THENQ=8+INT(RND(1)*2)
8065 IFQ>20THENQ=20-INT(RND(1)*2)
8070 NEXTF
8100 FORF=1TO24:IFPEEK(1024+(40*F))<>32T
HENPOKEV+1,(F*8)+32:POKEV,24:GOTO8120
8115 NEXTF
8120 FORF=1TO24:IFPEEK(1063+(40*F))<>32T
HEN8150
8130 NEXTF
8140 GOTO8400
8150 POKEV+3,F*8+32:POKEV+2,64:POKEV+16,
2
8400 POKEV+21,7
```

Line 8405-8500 PRINT the scores at the top of the screen.

```
8405 PRINT"■    PLAYER 1              PLA
YER 2"
8410 PRINT"■■       "SC(1)"
     "SC(2)
8500 RETURN
```

Line 9000-9050 Set up sprite shapes and registers. The shape of each sprite is held in DATA statements, lines 10000-10106.

```
9000 REM *** READ SPRITE DATA ***
9005 POKEV+21,0
9010 FORT=0TO191:READA:POKE13*64+T,A:NEX
TT:POKE2040,13:POKE2041,14
9015 FORT=0TO63:POKE704+T,0:NEXTT:POKE75
9,8:POKE762,28:POKE765,8:POKE2042,11
9020 V=53248
9030 POKEV+39,1:POKEV+40,1:POKEV+41,1
9050 POKEV+21,7
```

Line 9100-9500 Set up sound registers using DATA lines 11000 onwards.

```
9100 SO=54272
9110 FORT=0TO28:READA:POKESO+T,A:NEXTT
9500 RETURN
```

Line 10000-10107 Data for sprite shapes.

```
10000 REM *** SPRITE TANK LEFT  ***
10002 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0
10003 DATA 0, 0, 8, 0, 0, 56, 0, 0, 248,
 0, 227, 224
10004 DATA 1, 247, 128, 3, 254, 0, 3, 24
8, 0, 127, 255, 254
10005 DATA 255, 255, 255, 255, 255, 255,
 64, 0, 4, 81, 17, 20
10006 DATA 63, 255, 248, 0, 0, 0, 0, 0,
0, 0, 0, 0
10007 DATA 0, 0, 0, 0
10050 REM *** SPRITE TANK-RIGHT  ***
10052 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0
10053 DATA 32, 0, 0, 120, 0, 0, 62, 0, 0
, 15, 135, 0
10054 DATA 1, 239, 128, 0, 127, 192, 0,
31, 192, 127, 255, 254
10055 DATA 255, 255, 255, 255, 255, 255,
 32, 0, 2, 40, 136, 138
10056 DATA 31, 255, 252, 0, 0, 0, 0, 0,
0, 0, 0, 0
10057 DATA 0, 0, 0, 0
10100 REM *** SPRITE SHELL BURST  ***
10102 DATA 0, 0, 0, 0, 0, 16, 0, 128, 0,
 0, 0, 32
10103 DATA 0, 64, 0, 16, 0, 64, 0, 0, 0,
 8, 64, 128
10104 DATA 0, 0, 0, 4, 1, 2, 0, 0, 4, 2,
2, 8
10105 DATA 0, 0, 16, 1, 4, 32, 0, 0, 64,
 64, 136, 128
10106 DATA 32, 1, 0, 16, 82, 15, 12, 4,
112, 1, 11, 128
10107 DATA 0, 112, 0, 0
```

Line 11000-11040 Data for sound registers.

```
11000 REM --
11010 DATA0,20,0,0,128,26,250
11020 DATA0,20,0,0,16,9,240
11030 DATA0,7,0,0,128,9,240
11040 DATA0,0,0,15,0,0,0,0
```

INTERACTION

Y64 welcomes your program submissions, both in Basic and machine code (or a combination of the two), but please note the following points:

All submissions *must* be accompanied by a cassette or disk containing three copies of the program, a line-by-line description and variable-list, a description of the purpose anduse of the program, a printout if possible and a suitable sae.

Programs must be the original, unpublished work of the author(s) and must not have been submitted elsewhere.

Please mark everything with your name, address and program title. A daytime phone number helps in case we have any points we need to check with you. All programs will be returned whether or not they are accepted, and you will normally hear from us within four weeks of receipt.

Mail submissions to: *Keyboard Kapers, 14 Rathbone Place, London W1P 1DE.*

For all who seek to battle for our mortal good, there shall be the promise of great riches. For those who could crave the fight for its own sake alone, there is but a one-way ticket to Valhalla. John *and* Jan Peel *wrote the 20th century software version and* Phil Z Manchester *asked why.*

'Valhalla is the great hall of Odin, wherein he feasts with his chosen heroes, all those who have fallen bravely in battle, for all who die a peaceful death are excluded. When the heroes are not feasting they amuse themselves with fighting. Every day they ride out into the court or field and fight until they cut each other into pieces. This is their pastime; but when meal time comes they recover from their wounds and return to feast in Valhalla.' (The description of the legend of Valhalla, given by the 19th Century writer, Thomas Bulfinch, in his book *The Age of Fable.*)

You could say that Valhalla is an ideal subject for a computer-driven fantasy. Wander into the world of Viking myth, potter about gathering magical objects, fight a few trolls and giants, get killed and then when tea comes around, return healed to a feast of beans on toast.

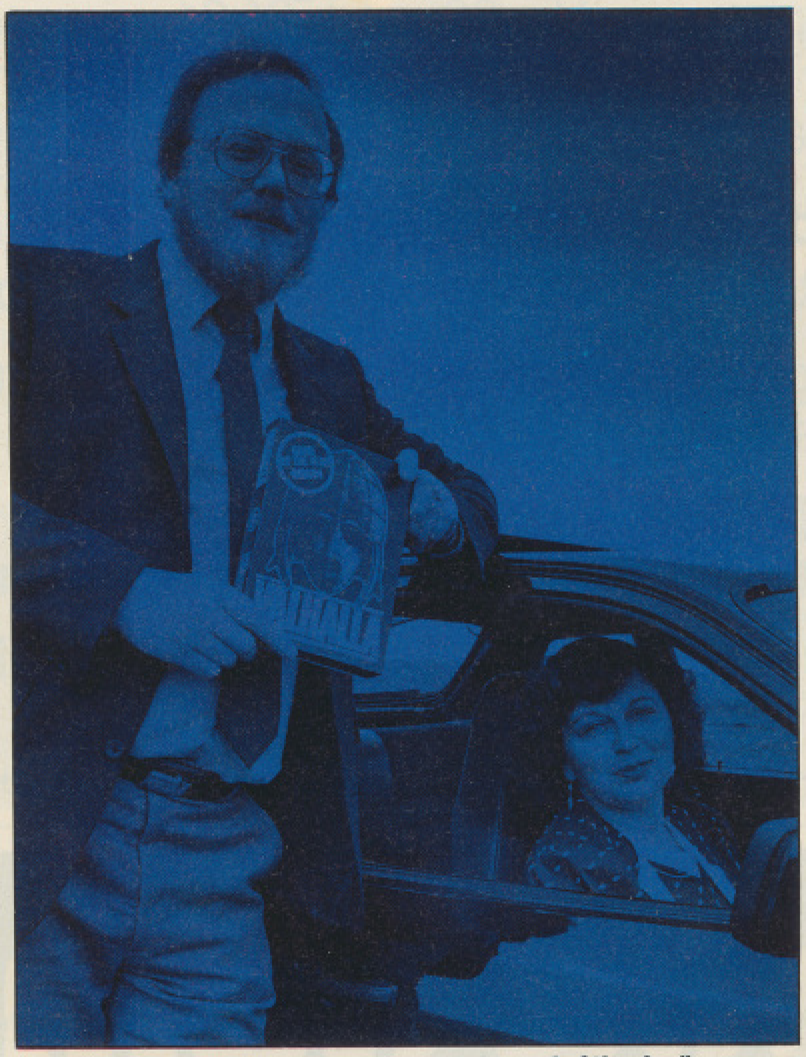
The heroes of Valhalla feasted on boar meat and mead — two commodities that are probably beyond the resources of the average hacker. Legend software provides you with only an instruction book and cassette — the esoteric catering is your problem.

John and Jan Peel, joint authors of *Valhalla*, were feasting on steak and full-bodied red wine when your correspondent arrived on their patch. The patch in question was Purley, a bastion of south London suburbia. Since then, Legend has moved to Chingford — a bastion of north east London suburbia. Legend has also moved the game it built for the Spectrum — onto the 64.

"We've made it more entertaining and speeded it up for the 64," said John. "The form is identical but it has better graphics, a faster run time and it's much livelier."

The Peels are adamant that *Valhalla* is more than just your average adventure game. They describe it as a piece of movie software and talk in terms of scripts rather than programs. The game can be run in 'movie mode' where you just sit back and watch the action. But the real fun is in actually participating in the fantasy. Unlike most adventure games which rely on cryptic clues and a slowly changing scene (the *Hobbit* comes to mind), *Valhalla* — as befits its mythical origins — is a mixture of adventure and arcade.

"Arcade games are a bit of a dead end," said John. "What we are seeing now are just variations on a few themes — richer graphics, more screens and a bit more of a plot. And pure adventure is a bit more complex than most people want."



The Peels: expecting a few million "at the end of the day"

The idea of animating the characters in an adventure and giving it some of the qualities of an arcade game is what sets *Valhalla* apart. As yet it's early days for what the Peels call a new medium (movie software) — but despite its primitiveness, *Valhalla* is certainly breaking new ground. However, the transition from Sinclair handwarmer to the 64 was not without its problems.

"Translating to the 64 was horrific. The memory map is a real mess, and we had to do all sorts of filthy things to get it to take a 35K program," Peel said. "Our technical people hate it. In fact, so deep is their love of the Commodore 64 that in future we will be developing 64 software on a BBC micro!"

Peel acknowledges that the 64 is a fast machine and that the graphics and sound features are very good. But he isn't satisfied with any of the machines currently on the market.

"I want to see some innovative hardware developments, a machine with a much faster processor (preferably more than one) and large amounts of memory. At the moment everyone is running shy of major developments. There's this MSX thing from Japan. That's a neanderthal approach to computing. It's really going to hold home computing back."

Peel reckons that the right home computer, with all the features that would make it really useful, will cost around £600 at today's prices (£400 at next year's) and have a half a mega-byte of storage. "The present crop of machines are a dead end." However, this blunt indictment of the home computer market doesn't extend to staying out of it; and Legend has chosen the two most popular computers as its target — the Spectrum and the 64.

Jan was responsible for working out the characters in *Valhalla* and the subtle interactions between them. Over several bottles of wine, we discussed the philosophy behind a game with, frankly, a very warlike and violent image. You don't actually get to cut video images to pieces... on the other hand, the game doesn't exactly present itself as a contribution to the peace movement.

"It's only fuelling fantasy — like *Coronation Street* or *Soap*. It doesn't exploit people's darker side at all. You start midway between good and evil in the game and you have to convince the goodies to come over to your side," explained Jan. "You can take an absolute baddy like Loki and convert him into a goody. That sort of thing needn't be there commercially."

That doesn't mean that the Peels shy away from commercial success. On the contrary, they expect *Valhalla* to put a few million in their bank accounts "at the end of the day" which will certainly help in paying for the obligatory black Porsche.

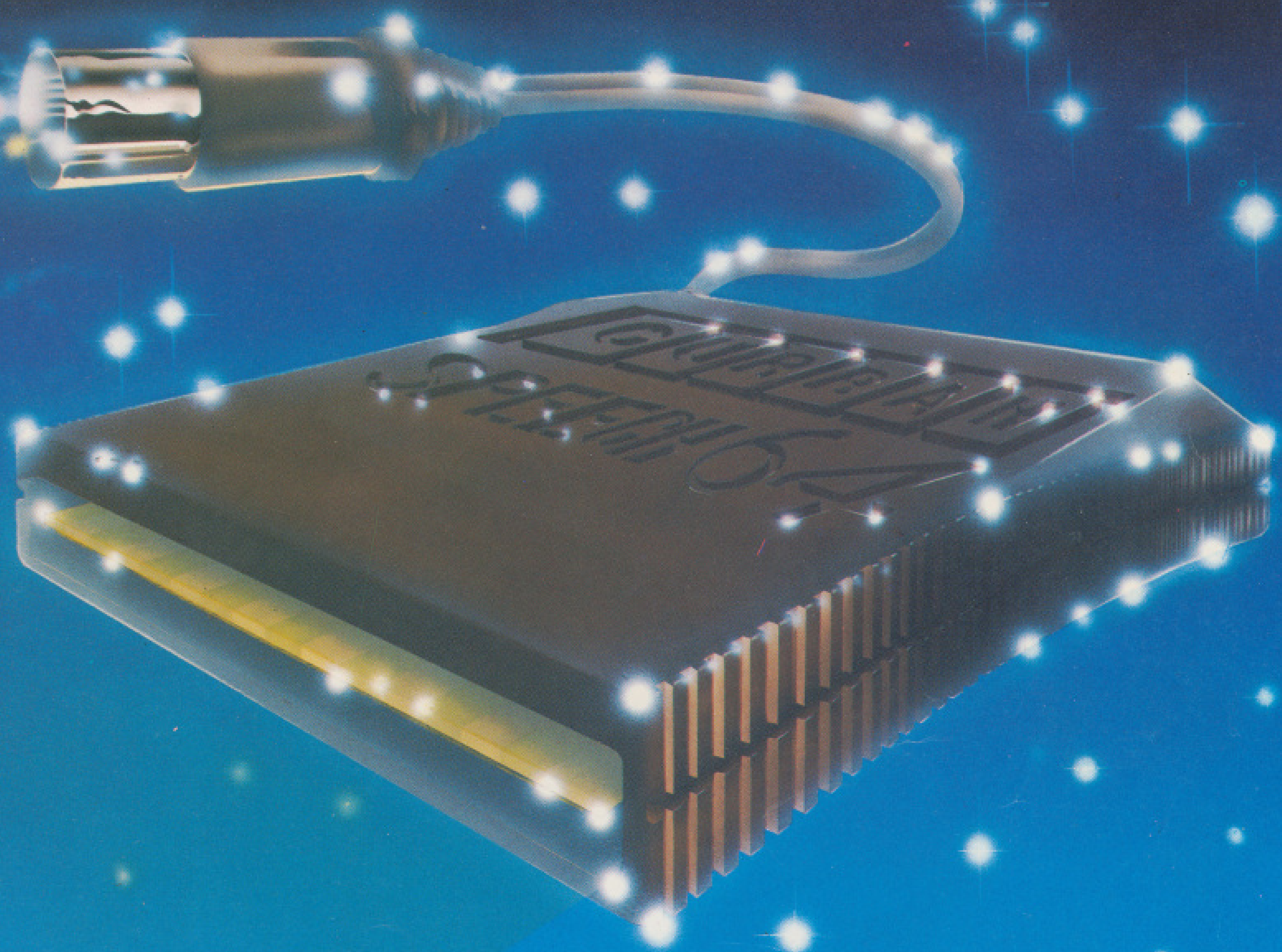
But the games market is a volatile one. Profits can come and go almost overnight. How does Legend see itself in the future? "We are a professional computer company which happens to be involved in games at the moment," said John. "In the future we shall be branching out into business software and looking at more expensive machines. There are a number of areas of expansion."

Even so, *Valhalla* will still be an important part of the company's activities, and plans for *Valhalla 2* are already well advanced. "The ideas for it were worked out before we did the first version," said John. "We just didn't have the technology available then".

So what will the sequel be like? "It'll be fantastic — very different from the existing game. It'll get rid of the debate between arcade and adventure once and for all," said Peel, refusing to elaborate on that somewhat cryptic remark.

Maybe it will include features that make the game more realistic — like a sword-fighting robot arm and a mead dispenser? We shall see.

FUN WITH SPEECH 64!



Speech Synthesiser for the Commodore 64

SPEECH 64 for the Commodore 64 is ready to talk immediately on power-up, has an infinite vocabulary and extra BASIC commands. Retailing at only **£29.95**, ***SPEECH 64***'s advanced features will give you, your family and friends lots more fun with your computer! Its sister unit µSPEECH — for the Sinclair Spectrum — is a smash hit in the UK and over 10 other countries, and has been awarded the CTA 'Product of the Year' accolade.

SPEECH 64 is easy to use! It needs no software to be loaded, it does not steal RAM from the BASIC operating system, or stop arcade style action.

With extended BASIC commands like SAY and its Text to Speech facility ***SPEECH 64*** can be programmed in plain English, just like this:
SAY "to say anything you want"

You can choose from two different voices, each with programmable intonation, and other commands control the voicing of keys as they are pressed — a useful educational aid for young children.

SPEECH 64 comes complete with full documentation and two free full colour posters. Watch out for ***SPEECH 64*** as it appears in retail outlets nationwide — or use the order form below, at no extra cost.

CURRAH

Computor Components Ltd

To: SPEECH 64 Offer, P.O. Box 1, Gateshead, Tyne & Wear, NE8 1AJ

Please Supply ....**SPEECH 64** unit(s) at £29.95 each incl. VAT & P & P

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'DEFEND' OR DIE!

IN ALLIGATA'S AMAZING OUTER SPACE SPECTACULAR...

COMMODORE 64 — ELECTRON



Once again Alligata's reputation for fast machine code action and high resolution graphics has combined to create a classic battle spectacular.

Guardian. Programming perfection, enthralling, fast screen scrolling action that will test skill and reflexes to breaking point in a desperate defensive mission against the invading landers. If successful in capturing humanoids from your planet surface and returning them to native outer space, the landers will mutate to take up a direct and deadly pursuit upon your space fighter. But things aren't quite that easy – the flying pods, swarmers, alien bombers and deadly baiters are just as dangerous. We know you don't like to be beaten but we're sure you'll eventually go under.

Loco. Skilfully manoeuvre the six track railway dodging aerial bombardment from planes and airships, avoiding fatal collision with oncoming handcarts aided only by your lethal smoke and steam and a unique split screen feature giving immediate action viewing with a master plan image of impending danger. **Son of Blagger.** Not many sequels live up to reputation, but in this drama of one, long continuous screen action the antics of Slippery Sid will keep you enthralled for days on end. **Contract Bridge.** Improve your technique with this sophisticated program where the computer bids and plays the other three hands in a full rubber plus scoring. **Aztec Tomb Part II.** If you solved the mystery of the South American jungle in part one, the sequel might be just within your grasp. **Blagger.** Platform programming at its best, 30 nerve racking screens featuring Roger the Dodger and his cat burglaring exploits. **Rocket Roger.** Walk, run, jump and even jet thrust your way round this single, continuously scrolling screen drama as rocket propelled Roger mines crystal fuel for his stranded mother ship, fighting off hordes of marauding nasties on the way.



Please indicate programs required

Tape Disk **CBM64**

- ☐ ☐ Guardian
- ☐ ☐ Blagger
- ☐ ☐ Contract Bridge (T £9.95)
- ☐ ☐ Loco
- ☐ ☐ Son of Blagger
- ☐ ☐ Rocket Roger

Electron

- ☐ Guardian
- ☐ Blagger
- ☐ Contract Bridge (T £9.95)

I enclose a cheque/PO ________ Payable to Alligata Software (Allow 75p for post and packaging)

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Alligata Software Ltd
1 Orange Street, Sheffield S1 4DW
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Despatch is normally made on receipt of order and should reach you within 7 days

Alligata Software Limited